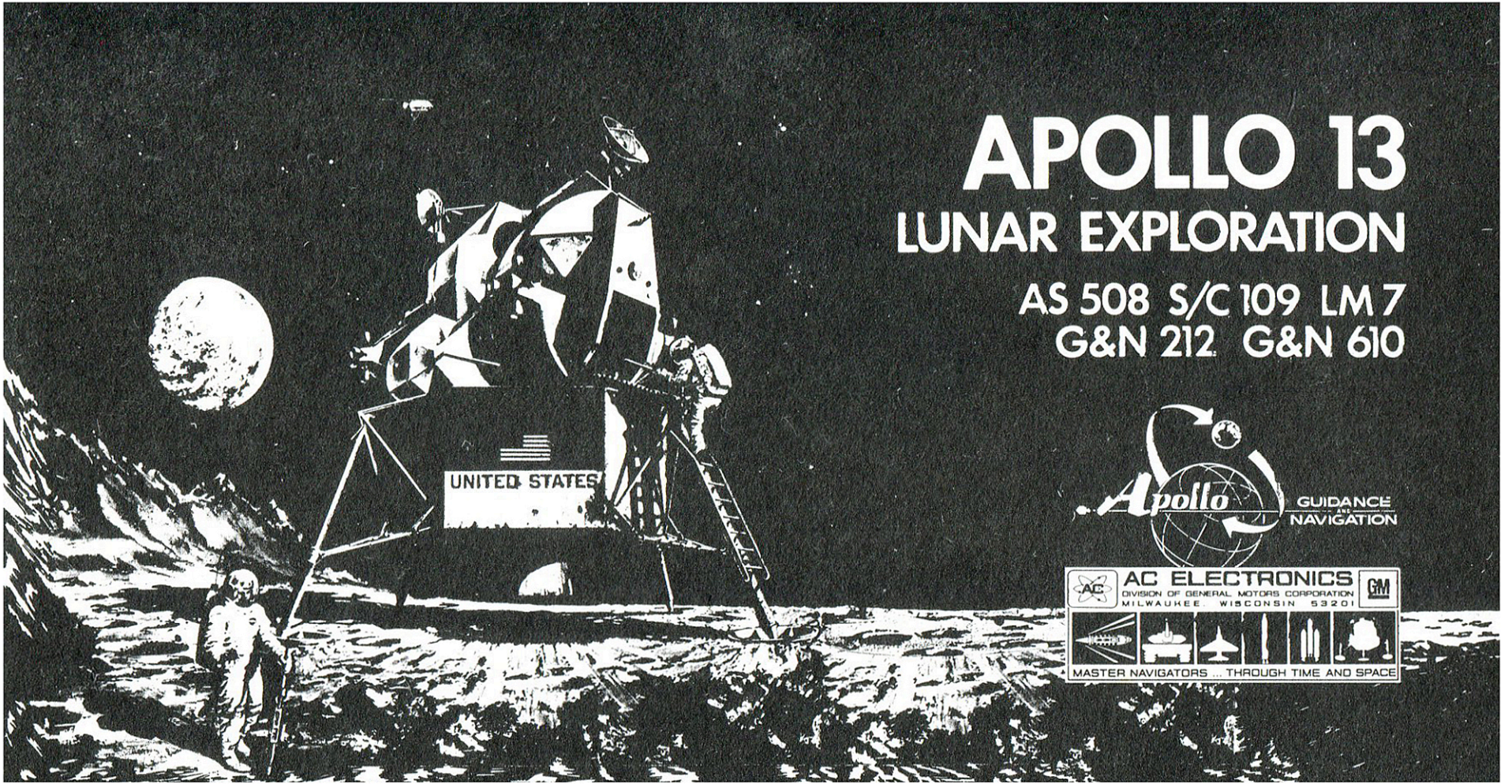

APOLLO 13
LUNAR EXPLORATION
AS 508 S/C 109 LM 7
G&N 212 G&N 610
UNITED STATES
Apollo
GUIDANCE AND NAVIGATION
AC ELECTRONICS
DIVISION OF GENERAL MOTORS CORPORATION
MILWAUKEE WISCONSIN 53201
MASTER NAVIGATORS ... THROUGH TIME AND SPACE

U.S. SPACE FLIGHT LOG

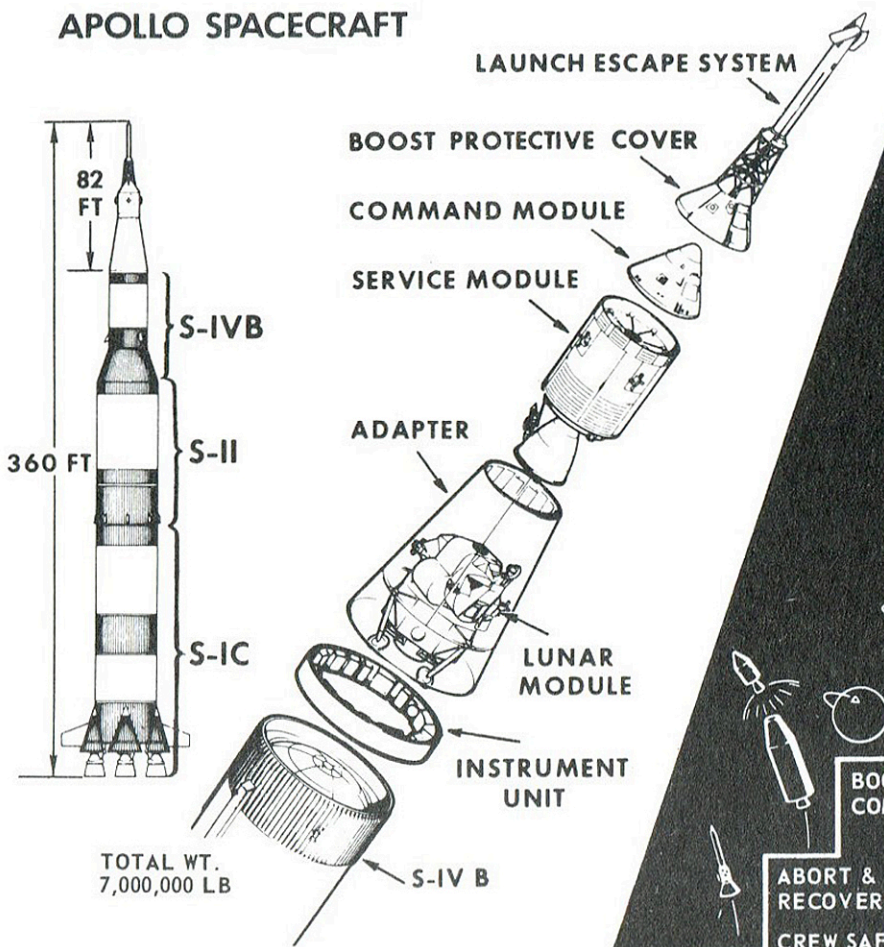
MISSION	ASTRONAUTS	LAUNCH DATE	ELAPSED TIME HR:MIN:SEC	TOTAL U.S. MANNED HOURS IN SPACE
Mercury-Redstone 3	Shepard	May 5, '61	00:15:22	00:15:22
Mercury-Redstone 4	Grissom	July 21, '61	00:15:37	00:30:59
Mercury-Atlas 6	Glenn	Feb. 20, '62	04:55:23	05:26:22
Mercury-Atlas 7	Carpenter	May 24, '62	04:56:05	10:22:27
Mercury-Atlas 8	Schirra	Oct. 3, '62	09:13:11	19:35:38
Mercury-Atlas 9	Cooper	May 15, '63	34:19:49	53:55:27
Gemini-Titan III	Grissom-Young	Mar. 23, '65	04:53:00	63:41:27
Gemini-Titan IV	McDivitt-White	June 3, '65	97:56:11	259:33:49
Gemini-Titan V	Cooper-Conrad	Aug. 21, '65	190:55:14	641:24:17
Gemini-Titan VII	Borman-Lovell	Dec. 4, '65	330:35:31	1302:35:19
Gemini-Titan VI-A	Schirra-Stafford	Dec. 15, '65	25:51:24	1354:18:07
Gemini-Titan VIII	Armstrong-Scott	Mar. 16, '66	10:41:26	1375:40:59
Gemini-Titan IX-A	Stafford-Cernan	June 3, '66	72:21:00	1520:22:59
Gemini-Titan X	Young-Collins	July 18, '66	70:46:39	1661:56:17
Gemini-Titan XI	Conrad-Gordon	Sept. 12, '66	71:17:08	1804:30:33
Gemini-Titan XII	Lovell-Aldrin	Nov. 11, '66	94:34:31	1993:39:35
Apollo 7 Saturn 1B	Shirra-Eisele-Cunningham	Oct. 11, '67	260:06:18	2773:58:29
Apollo 8 Saturn V	Borman-Lovell-Anders	Dec. 21, '68	147:00:11	3214:59:02
Apollo 9 Saturn V	McDivitt-Scott-Schweickart	Mar. 3, '69	241:00:53	3938:01:41
Apollo 10 Saturn V	Stafford-Young-Cernan	May 18, '69	192:03:23	4514:11:50
Apollo 11 Saturn V	Armstrong-Aldrin-Collins	July 16, '69	195:18:35	5100:07:35
Apollo 12 Saturn V	Conrad-Gordon-Bean	Nov. 14, '69	244:36:24	5833:56:47
Apollo 13 Saturn V	Lovell-Mattingly-Haise	April 11, '70		

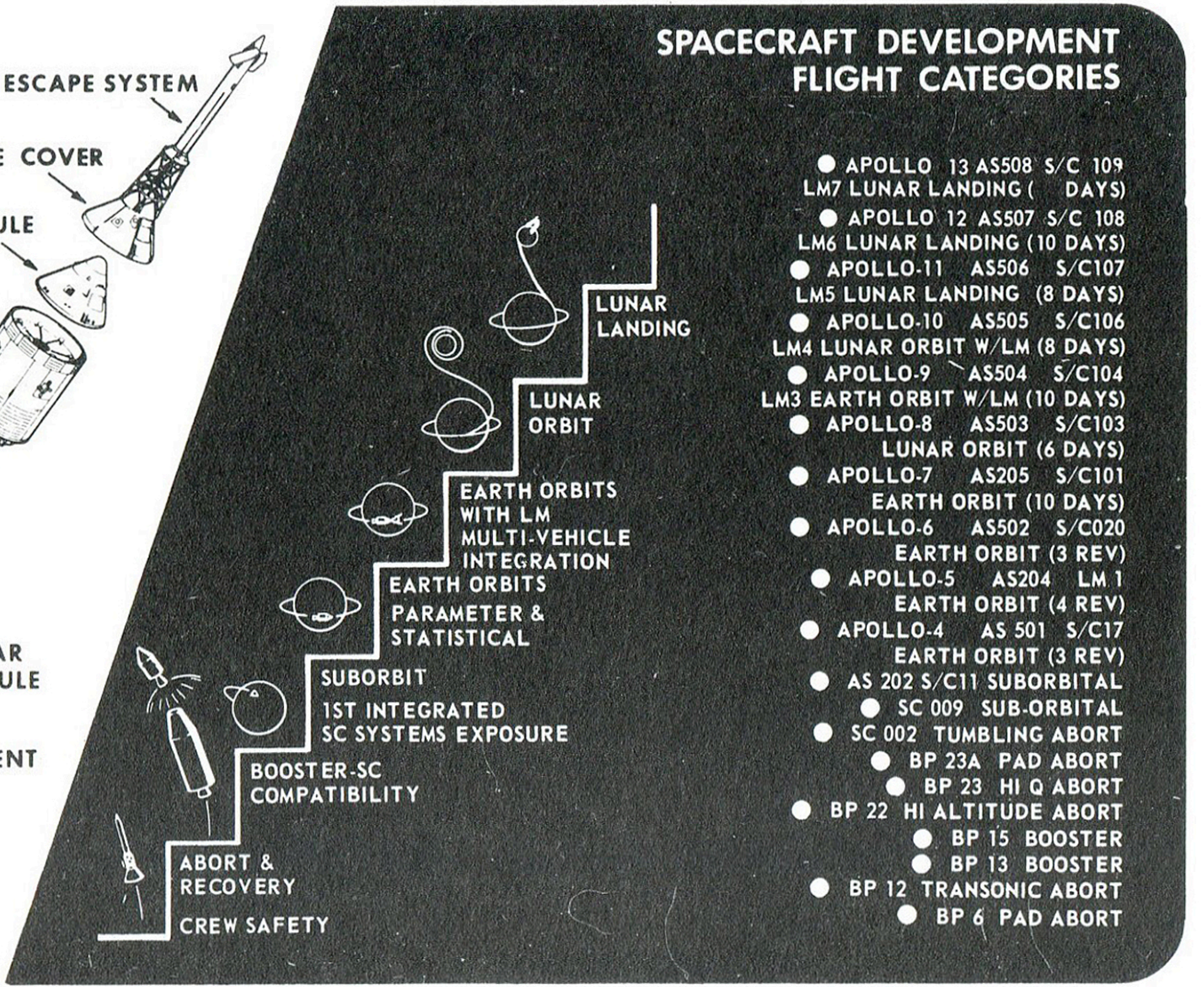
APOLLO 13 MISSION DESCRIPTION

1. Manned: Prime Crew — James A. Lovell Jr. (CDR), Thomas K. Mattingly (CMP), Fred W. Haise Jr. (LMP); Back-up Crew — John W. Young (CDR), John L. Swigert Jr. (CMP), Charles M. Duke Jr. (LMP)
2. Sixth Manned Saturn V Mission
3. Third Lunar Landing Mission
4. Planned duration of Apollo 13 241 hours
5. Booster Saturn V Booster #508
6. Spacecraft CSM #109 and LM #7
7. Block II G & N System #212 LM G & N System #610

The Apollo 13 Mission will be approximately 241 hours duration. Lunc surface activities will be conducted for a period not more than 35 hours and will include (2) two EVA periods for surface exploration and experiment deployment. Maximum radius of operation from the landed spacecraft will be as much as 3,000 feet. The primary objectives of this mission include the following:

1. Perform selenological inspection, survey and sampling in a highland structure.
2. Deploy ALSEP consistent with a seismic net.
3. Develop the capability to conduct a mission to a specific site.
4. Demonstrate the point landing capability.
5. Develop man's capability to work in the lunar environment.


APOLLO SPACECRAFT
LAUNCH ESCAPE SYSTEM
BOOST PROTECTIVE COVER
COMMAND MODULE
SERVICE MODULE
ADAPTER
LUNAR MODULE
INSTRUMENT UNIT
S-IV B
82 FT
360 FT
S-IVB
S-II
S-IC
TOTAL WT.
7,000,000 LB

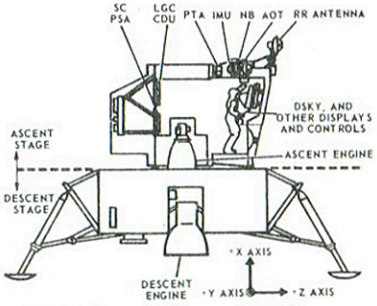

SPACECRAFT DEVELOPMENT
FLIGHT CATEGORIES
LUNAR LANDING
LUNAR ORBIT
EARTH ORBITS WITH LM MULTI-VEHICLE INTEGRATION
EARTH ORBITS PARAMETER & STATISTICAL
SUBORBIT
1ST INTEGRATED SC SYSTEMS EXPOSURE
BOOSTER-SC COMPATIBILITY
ABORT & RECOVERY
CREW SAFETY
● APOLLO 13 AS508 S/C 109 LM7 LUNAR LANDING (DAYS)
● APOLLO 12 AS507 S/C 108 LM6 LUNAR LANDING (10 DAYS)
● APOLLO-11 AS506 S/C107 LM5 LUNAR LANDING (8 DAYS)
● APOLLO-10 AS505 S/C106 LM4 LUNAR ORBIT W/LM (8 DAYS)
● APOLLO-9 AS504 S/C104 LM3 EARTH ORBIT W/LM (10 DAYS)
● APOLLO-8 AS503 S/C103 LUNAR ORBIT (6 DAYS)
● APOLLO-7 AS205 S/C101 EARTH ORBIT (10 DAYS)
● APOLLO-6 AS502 S/C020 EARTH ORBIT (3 REV)
● APOLLO-5 AS204 LM 1 EARTH ORBIT (4 REV)
● APOLLO-4 AS 501 S/C17 EARTH ORBIT (3 REV)
● AS 202 S/C11 SUBORBITAL
● SC 009 SUB-ORBITAL
● SC 002 TUMBLING ABORT
● BP 23A PAD ABORT
● BP 23 HI Q ABORT
● BP 22 HI ALTITUDE ABORT
● BP 15 BOOSTER
● BP 13 BOOSTER
● BP 12 TRANSONIC ABORT
● BP 6 PAD ABORT

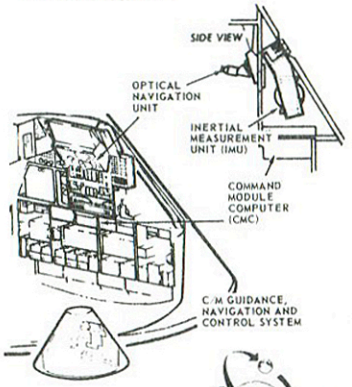
LM GUIDANCE and NAVIGATION EQUIPMENT.....

CM GUIDANCE, NAVIGATION and CONTROL SYSTEM

THE APOLLO GUIDANCE AND NAVIGATION SYSTEM IS COMPOSED OF THREE BASIC SUBSYSTEMS: INERTIAL, OPTICAL AND COMPUTER.

1. The inertial guidance subsystem is composed of inertial measurement unit (IMU) and associated equipment. This subsystem performs three major functions: (A) Measures changes in spacecraft attitude; (B) Measures spacecraft velocity due to thrust; and (C) Assists in generating steering signals.
2. The optical navigation subsystem is composed of a space sextant and a scanning telescope. Sightings on celestial bodies and landmarks on the moon and earth are used by the computer subsystem to determine the spacecraft's position and velocity and to align the inertial reference within the IMU.
3. The command module computer (CMC) provides five major functions: (A) Calculates steering signals and engine discretes necessary to keep the spacecraft on the required trajectory; (B) Positions the stable member in the IMU to a coordinate system defined by precise optical measurements; (C) Positions the optical unit to celestial objects; (D) Conducts limited malfunction isolation of the G&N system by monitoring the level and rate of system signals; and (E) Supplies pertinent spacecraft condition information to the display and control panel.





Apollo GUIDANCE, NAVIGATION

AC ELECTRONICS
DIVISION OF GENERAL MOTORS CORPORATION
MILWAUKEE WISCONSIN 53201
GM

MASTER NAVIGATORS ... THROUGH TIME AND SPACE

INERTIAL MEASUREMENT UNIT (IMU) and associated equipment performs three major functions; (A) Measures changes in LM attitude, (B) Assists in generating steering commands, and (C) Measures LM velocity changes due to thrust.

ALIGNMENT OPTICAL TELESCOPT (AOT) Provides star sighting data which is manually inserted into the LM Guidance Computer for establishing the inertial reference.

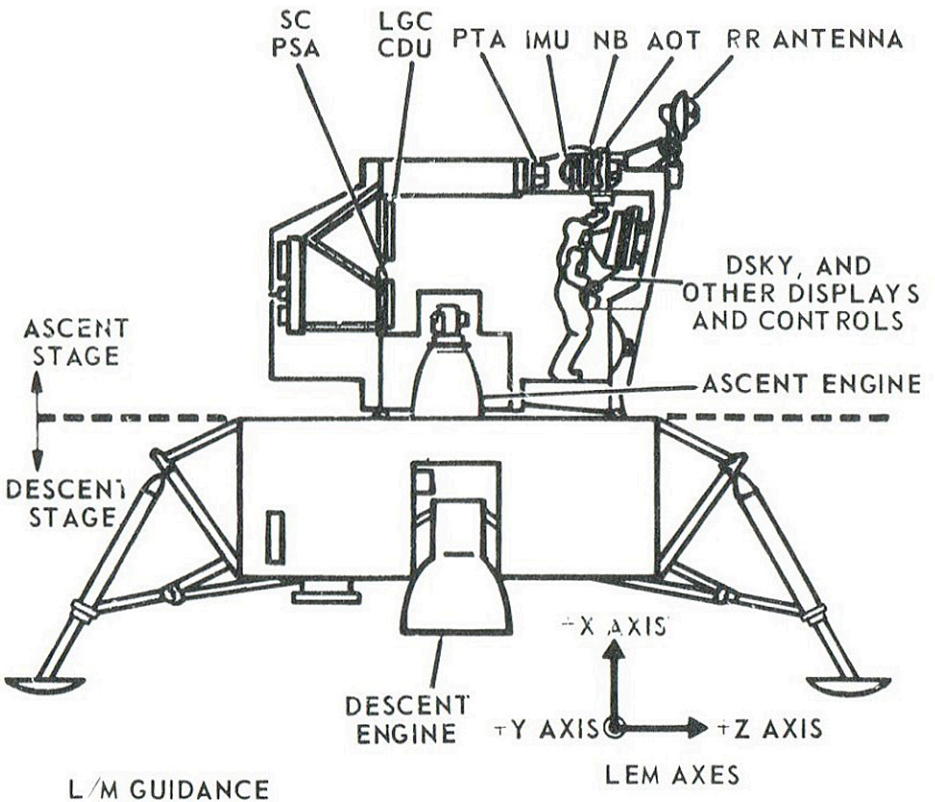
NAVIGATION BASE (NAV BASE) Provides an accurate mounting base for the Alignment Optical Telescope (AOT) and the Inertial Measurement Unit.

LM GUIDANCE COMPUTER (LGC) Performs four major functions: (A) Calculates steering signals and engine discretes necessary to keep the LM on the required trajectory, (B) Positions the stable member in the IMU to a coordinate system defined by precise optical measurements, (C) Conducts limited malfunction isolation of the PGNCS by monitoring the level and rate of system signals and (D) Supplies pertinent LM condition information to the display and control panels.

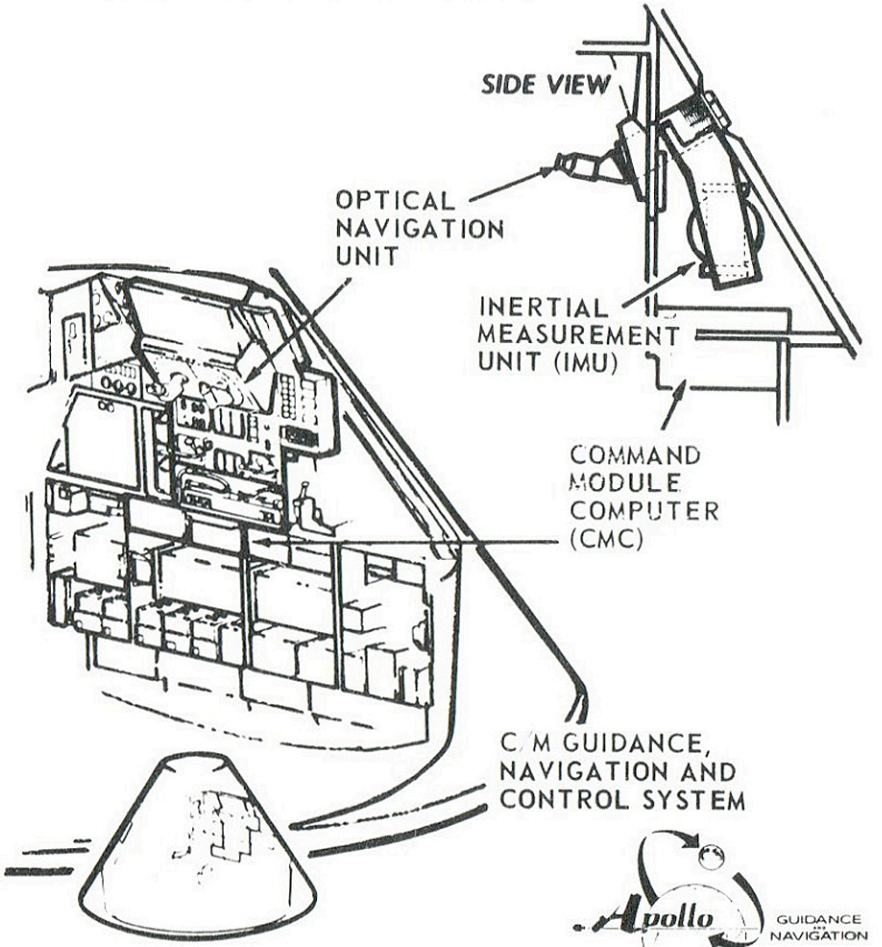
DISPLAY AND KEYBOARD (DSKY) Provides a two-way communication link between the operator and the LGC and the following functions may be performed: (A) Loading of data into the LGC and (B) Display of data and system configuration to the operator.

COUPLING DATA UNIT (CDU) The CDU, an all-electronic device, is used as an interface element between the following: (A) The inertial subsystem and computer subsystem and (B) The computer subsystem and the controls. This unit functions primarily as an analog to digital or digital to analog converter.

AC GUIDANCE & NAVIGATION EQUIPMENT LOCATION



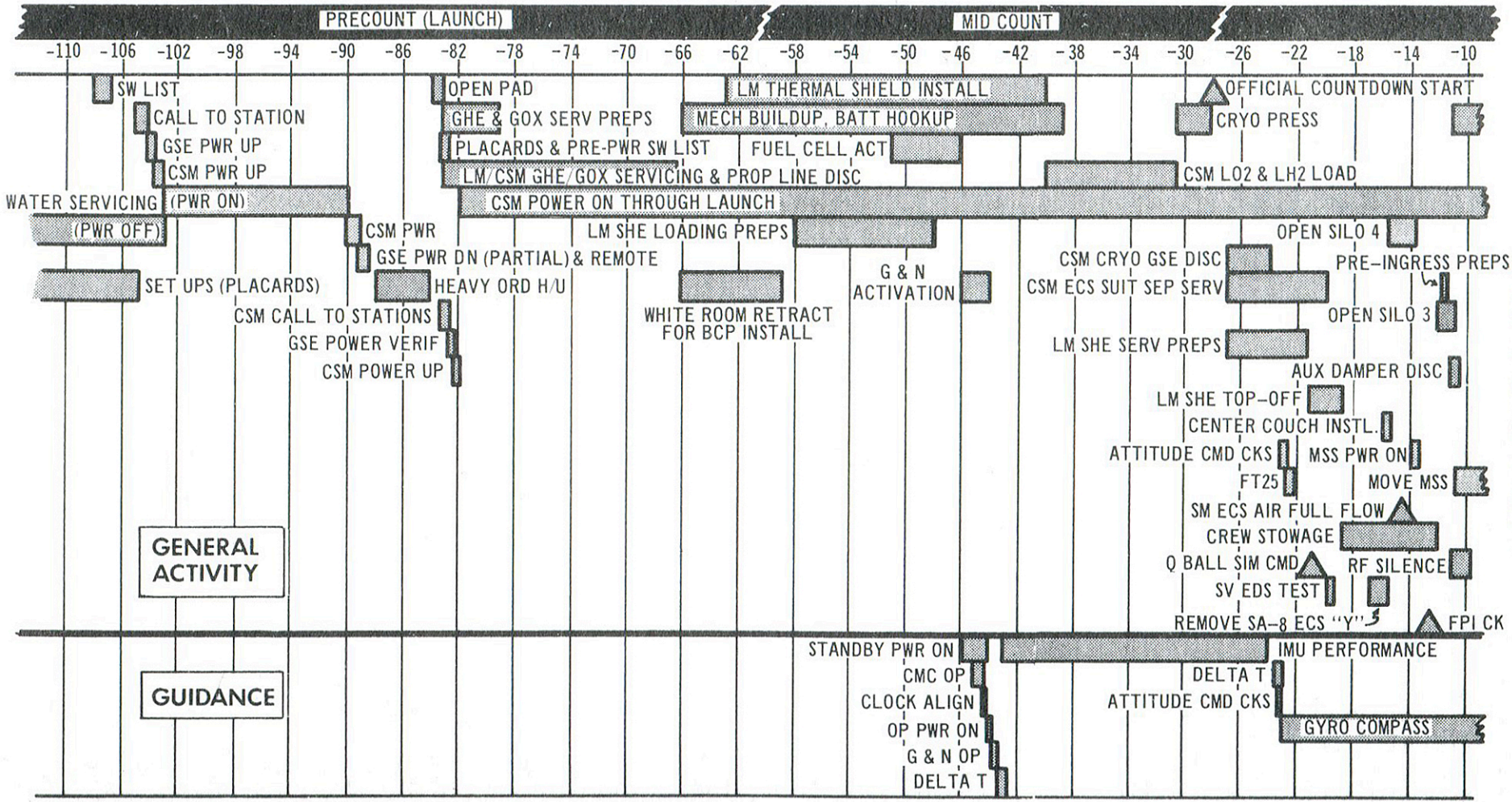
L/M GUIDANCE
& NAVIGATION EQUIPMENT

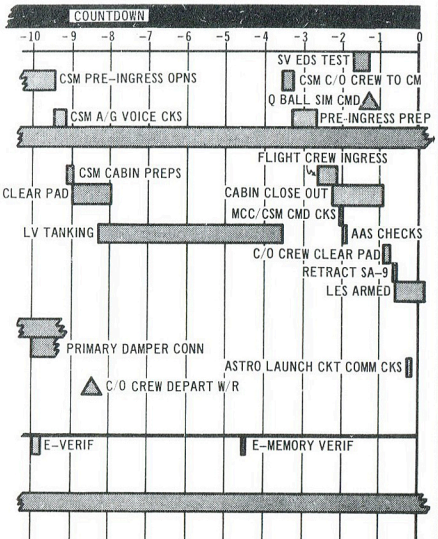


Apollo GUIDANCE AND NAVIGATION

AC ELECTRONICS
DIVISION OF GENERAL MOTORS CORPORATION

LAUNCH COUNTDOWN SC 109

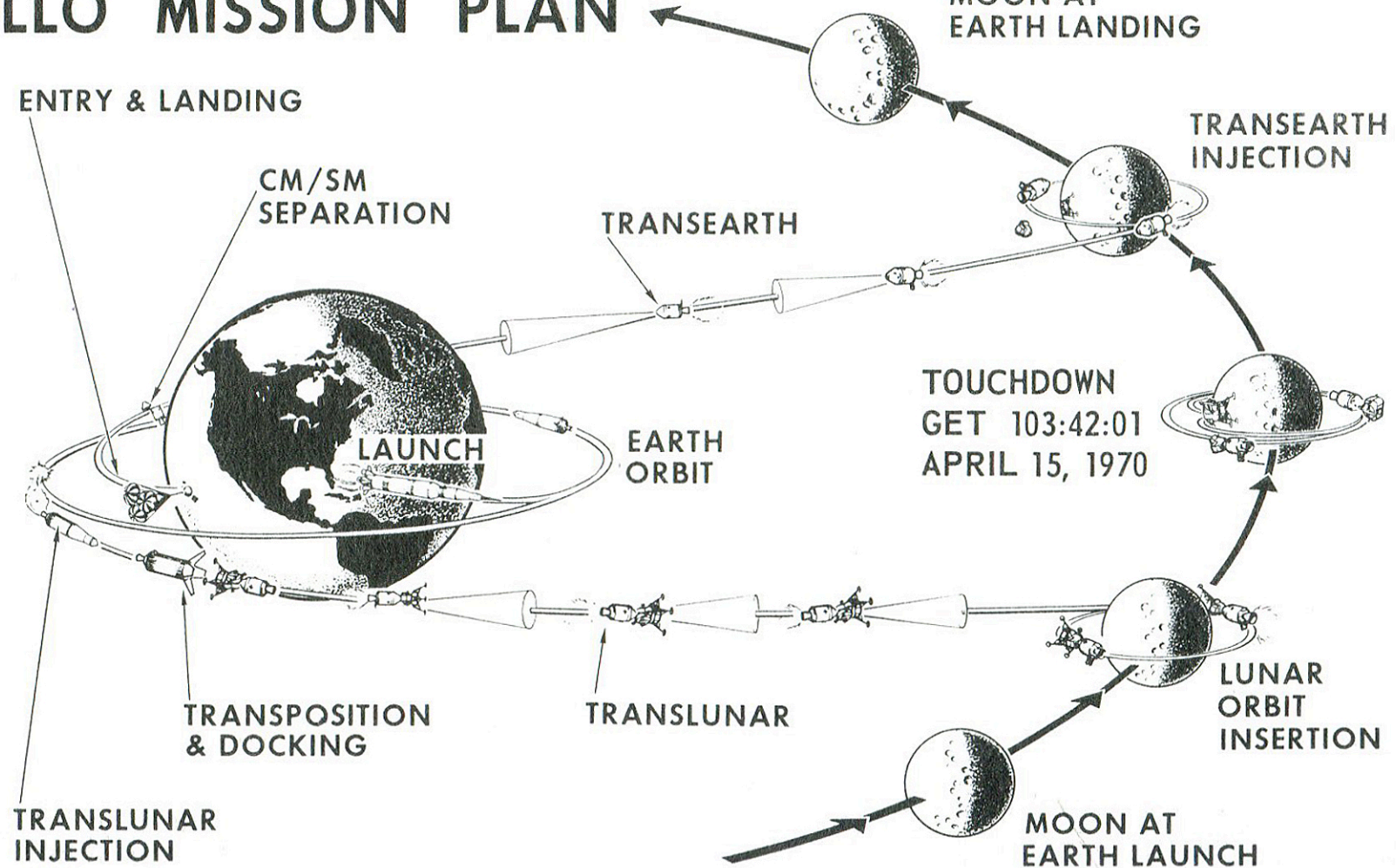




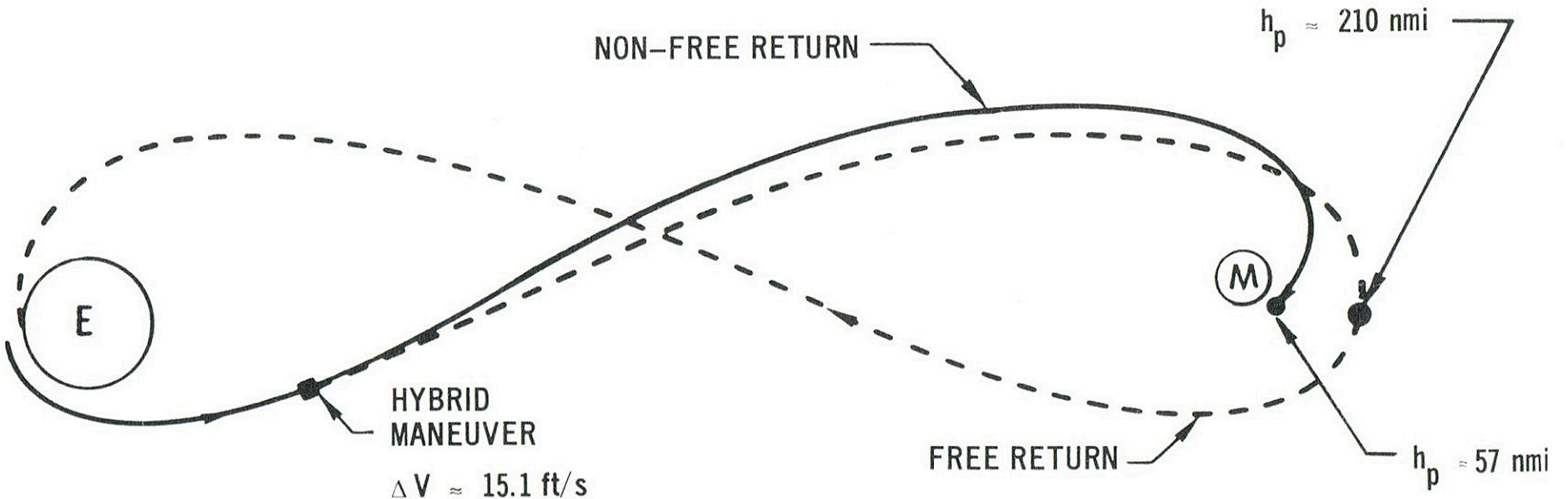
SEQUENCE OF MAJOR EVENTS

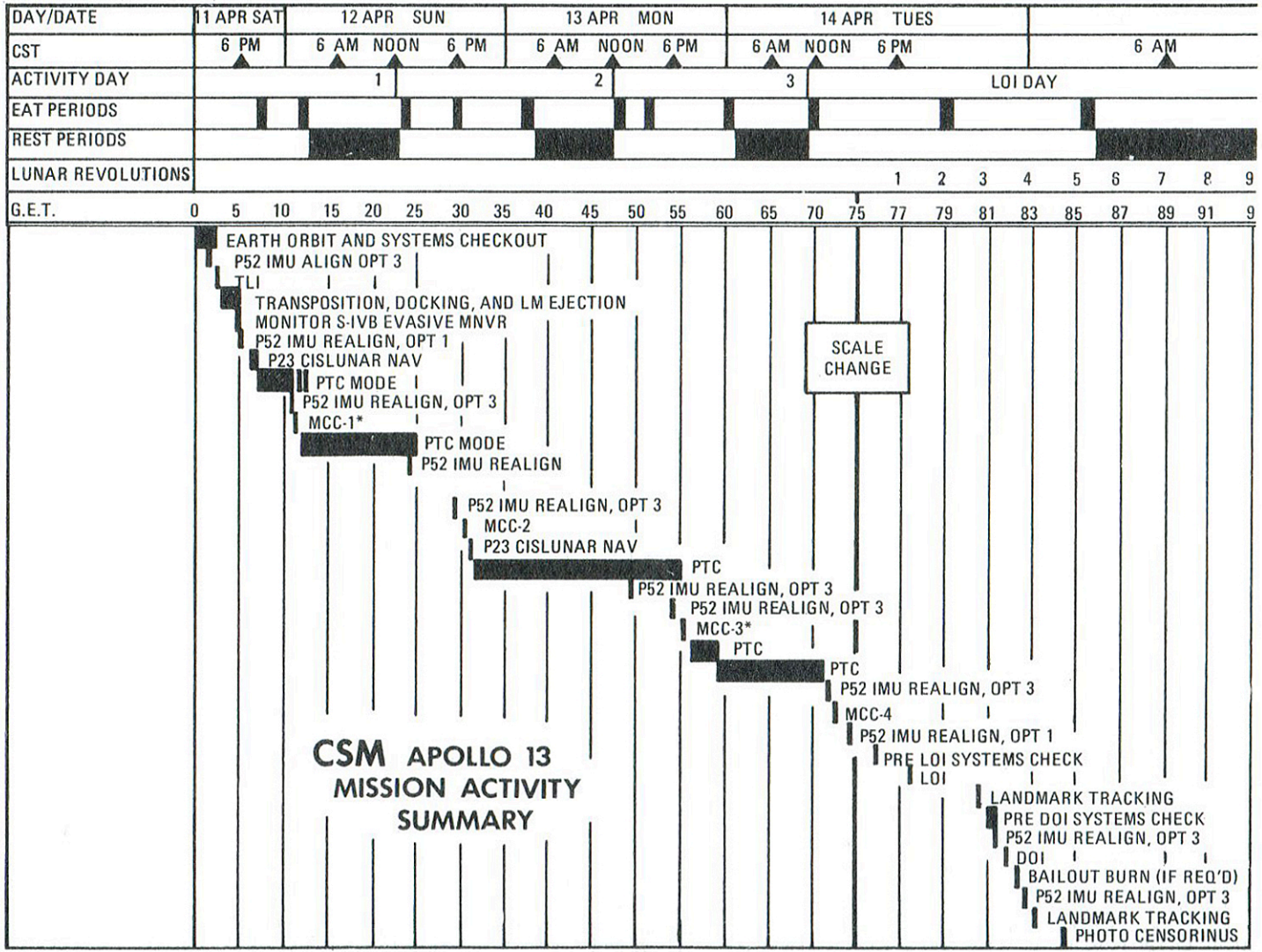
	EVENT	TIME HR:MIN:SEC G.E.T	TIME HR:MIN:SEC C.S.T.	BURN TIME SEC
			April 11, 1970	
LAUNCH		00:00:00	13:13:00	
	Earth Orbit Insertion	00:11:39.6	13:24:39.6	11 min 39.6 sec
	Translunar Injection	02:35:23.5	15:48:23.5	325.4
	S-IVB Evasive Maneuver	04:19:24	17:32:24	
			April 14, 1970	
	Lunar Orbit Insertion	77:24:52.9	18:37:52.9	356.6
	Descent Orbit Insertion	81:45:20.5	22:58:20.5	23.1
			April 15, 1970	
	CSM/LM Undock & Sep	99:16:21	16:29:21	
	CSM Circularization	100:35:05.2	17:48:05.2	3.9
DESCENT				
	PDI	103:30:35.3	20:43:35.3	Burn Iniation
	Landing	103:42:01.5	20:55:01.5	11 min 26 sec
ASCENT			April 17, 1970	
	LM Lift-Off	137:09:15.8	06:22:15.8	
	LM Insertion	137:16:23.1	06:29:23.1	427.3
RENDEZVOUS				
	CSI	138:06:01	07:19:01	44.4
	CDH	139:04:14.1	08:37:14.1	0.0
	TPI	139:45:40.1	08:58:40.1	22.1
	Braking	140:26:55.5	09:39:55.5	27.4
	Docking	140:45:00	09:58:00	
	LM Jettison	143:04:00	12:17:00	
	Transearth Injection	167:28:58.3	April 18, 1970 12:41:58.3	135.0
	Entry Interface	240:49:37.6	April 21, 1970 14:02:37.6	
	Splashdown	241:03:25.6	15:32:25.6	Lat. 1.559° Long. 157.5°

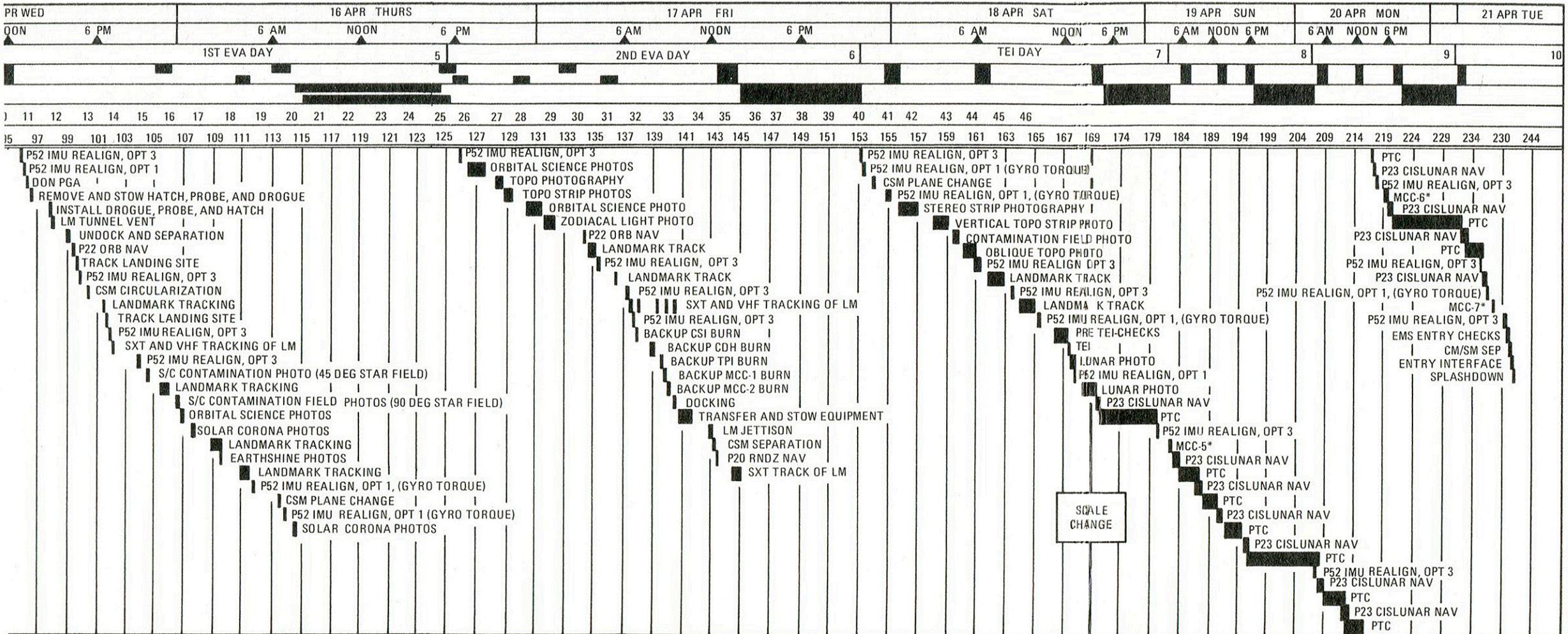
APOLLO MISSION PLAN

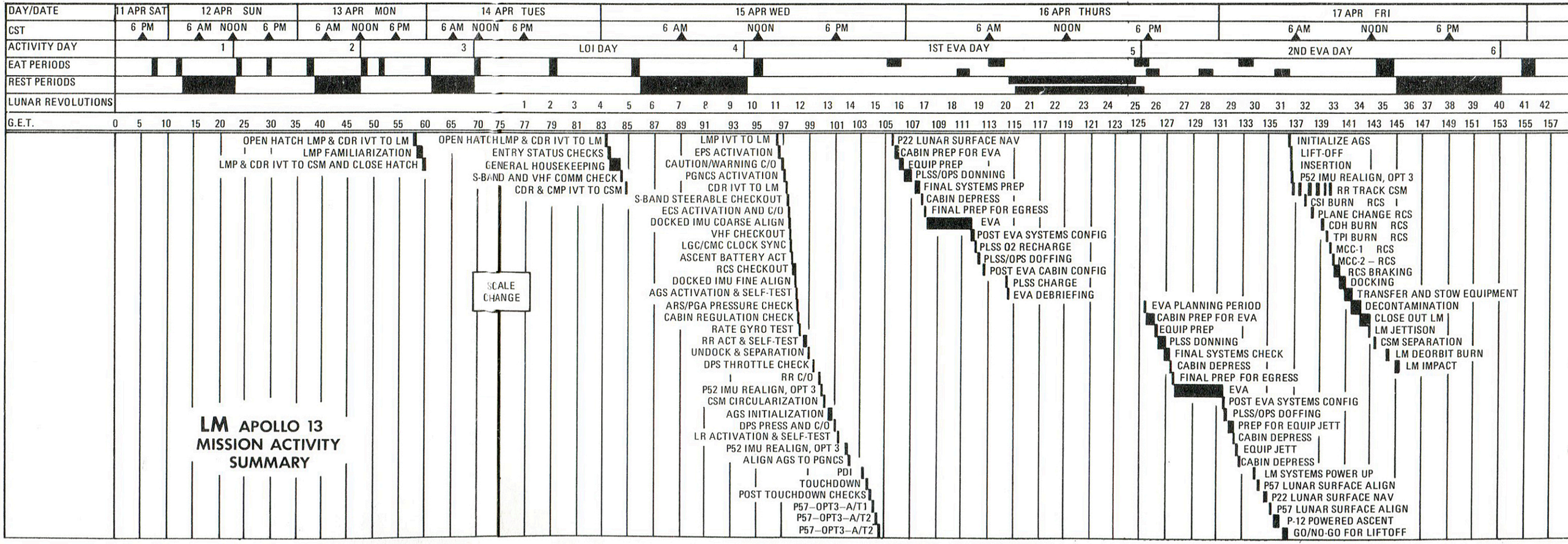


APOLLO 13 HYBRID MISSION PROFILE




DAY/DATE
11 APR SAT
12 APR SUN
13 APR MON
14 APR TUES
CST
6 PM
6 AM NOON 6 PM
6 AM NOON 6 PM
6 AM NOON 6 PM
6 AM
ACTIVITY DAY
1
2
3
LOI DAY
EAT PERIODS
REST PERIODS
LUNAR REVOLUTIONS
1 2 3 4 5 6 7 8 9
G.E.T.
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 77 79 81 83 85 87 89 91 9
EARTH ORBIT AND SYSTEMS CHECKOUT
P52 IMU ALIGN OPT 3
LI
TRANSPOSITION, DOCKING, AND LM EJECTION
MONITOR S-IVB EVASIVE MNVR
P52 IMU REALIGN, OPT 1
P23 CISLUNAR NAV
PTC MODE
P52 IMU REALIGN, OPT 3
MCC-1*
PTC MODE
P52 IMU REALIGN
SCALE CHANGE
P52 IMU REALIGN, OPT 3
MCC-2
P23 CISLUNAR NAV
PTC
P52 IMU REALIGN, OPT 3
P52 IMU REALIGN, OPT 3
MCC-3*
PTC
PTC
P52 IMU REALIGN, OPT 3
MCC-4
P52 IMU REALIGN, OPT 1
PRE LOI SYSTEMS CHECK
LOI
LANDMARK TRACKING
PRE DOI SYSTEMS CHECK
P52 IMU REALIGN, OPT 3
DOI
BAILOUT BURN (IF REQ'D)
P52 IMU REALIGN, OPT 3
LANDMARK TRACKING
PHOTO CENSORINUS
CSM APOLLO 13
MISSION ACTIVITY
SUMMARY


PR WED
OON
6 PM
16 APR THURS
6 AM
NOON
6 PM
17 APR FRI
6 AM
NOON
6 PM
18 APR SAT
6 AM
NOON
6 PM
19 APR SUN
6 AM NOON 6 PM
20 APR MON
6 AM NOON 6 PM
21 APR TUE
1ST EVA DAY
2ND EVA DAY
TEI DAY
5
6
7
8
9
10
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46
95 97 99 101 103 105 107 109 111 113 115 117 119 121 123 125 127 129 131 133 135 137 139 141 143 145 147 149 151 153 155 157 159 161 163 165 167 169 174 179 184 189 194 199 204 209 214 219 224 229 234 230 244
P52 IMU REALIGN, OPT 3
P52 IMU REALIGN, OPT 1
DON PGA
REMOVE AND STOW HATCH, PROBE, AND DROGUE
INSTALL DROGUE, PROBE, AND HATCH
LM TUNNEL VENT
UNDOCK AND SEPARATION
P22 ORB NAV
TRACK LANDING SITE
P52 IMU REALIGN, OPT 3
CSM CIRCULARIZATION
LANDMARK TRACKING
TRACK LANDING SITE
P52 IMU REALIGN, OPT 3
SXT AND VHF TRACKING OF LM
P52 IMU REALIGN, OPT 3
S/C CONTAMINATION PHOTO (45 DEG STAR FIELD)
LANDMARK TRACKING
S/C CONTAMINATION FIELD PHOTOS (90 DEG STAR FIELD)
ORBITAL SCIENCE PHOTOS
SOLAR CORONA PHOTOS
LANDMARK TRACKING
EARTHSHINE PHOTOS
LANDMARK TRACKING
P52 IMU REALIGN, OPT 1, (GYRO TORQUE)
CSM PLANE CHANGE
P52 IMU REALIGN, OPT 1 (GYRO TORQUE)
SOLAR CORONA PHOTOS
P52 IMU REALIGN, OPT 3
ORBITAL SCIENCE PHOTOS
TOPO PHOTOGRAPHY
TOPO STRIP PHOTOS
ORBITAL SCIENCE PHOTO
ZODIACAL LIGHT PHOTO
P22 ORB NAV
LANDMARK TRACK
P52 IMU REALIGN, OPT 3
LANDMARK TRACK
P52 IMU REALIGN, OPT 3
SXT AND VHF TRACKING OF LM
P52 IMU REALIGN, OPT 3
BACKUP CSI BURN
BACKUP CDH BURN
BACKUP TPI BURN
BACKUP MCC-1 BURN
BACKUP MCC-2 BURN
DOCKING
TRANSFER AND STOW EQUIPMENT
LM JETTISON
CSM SEPARATION
P20 RNDZ NAV
SXT TRACK OF LM
P52 IMU REALIGN, OPT 3
P52 IMU REALIGN, OPT 1 (GYRO TORQUE)
CSM PLANE CHANGE
P52 IMU REALIGN, OPT 1, (GYRO TORQUE)
STEREO STRIP PHOTOGRAPHY
VERTICAL TOPO STRIP PHOTO
CONTAMINATION FIELD PHOTO
OBLIQUE TOPO PHOTO
P52 IMU REALIGN OPT 3
LANDMARK TRACK
P52 IMU REALIGN, OPT 3
LANDMA K TRACK
P52 IMU REALIGN, OPT 1, (GYRO TORQUE)
PRE TEI CHECKS
TEI
LUNAR PHOTO
P52 IMU REALIGN, OPT 1
LUNAR PHOTO
P23 CISLUNAR NAV
PTC
P52 IMU REALIGN, OPT 3
MCC-5*
P23 CISLUNAR NAV
PTC
P23 CISLUNAR NAV
PTC
P23 CISLUNAR NAV
PTC
P23 CISLUNAR NAV
PTC
P52 IMU REALIGN, OPT 3
P23 CISLUNAR NAV
PTC
P23 CISLUNAR NAV
PTC
SCALE CHANGE
PTC
P23 CISLUNAR NAV
P52 IMU REALIGN, OPT 3
MCC-6*
P23 CISLUNAR NAV
PTC
P23 CISLUNAR NAV
PTC
P52 IMU REALIGN, OPT 3
P23 CISLUNAR NAV
P52 IMU REALIGN, OPT 1, (GYRO TORQUE)
MCC-7*
P52 IMU REALIGN, OPT 3
EMS ENTRY CHECKS
CM/SM SEP
ENTRY INTERFACE
SPLASHDOWN


DAY/DATE
11 APR SAT
12 APR SUN
13 APR MON
14 APR TUES
15 APR WED
16 APR THURS
17 APR FRI
CST
6 PM
6 AM NOON 6 PM
ACTIVITY DAY
1
2
3
LOI DAY
4
1ST EVA DAY
5
2ND EVA DAY
6
EAT PERIODS
REST PERIODS
LUNAR REVOLUTIONS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42
G.E.T.
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 77 79 81 83 85 87 89 91 93 95 97 99 101 103 105 107 109 111 113 115 117 119 121 123 125 127 129 131 133 135 137 139 141 143 145 147 149 151 153 155 157
OPEN HATCH
LMP & CDR IVT TO LM
LMP FAMILIARIZATION
LMP & CDR IVT TO CSM AND CLOSE HATCH
OPEN HATCH
LMP & CDR IVT TO LM
ENTRY STATUS CHECKS
GENERAL HOUSEKEEPING
S-BAND AND VHF COMM CHECK
CDR & CMP IVT TO CSM
SCALE CHANGE
LMP IVT TO LM
EPS ACTIVATION
CAUTION/WARNING C/O
PGNCS ACTIVATION
CDR IVT TO LM
S-BAND STEERABLE CHECKOUT
ECS ACTIVATION AND C/O
DOCKED IMU COARSE ALIGN
VHF CHECKOUT
LGC/CMC CLOCK SYNC
ASCENT BATTERY ACT
RCS CHECKOUT
DOCKED IMU FINE ALIGN
AGS ACTIVATION & SELF-TEST
ARS/PGA PRESSURE CHECK
CABIN REGULATION CHECK
RATE GYRO TEST
RR ACT & SELF-TEST
UNDOCK & SEPARATION
DPS THROTTLE CHECK
RR C/O
P52 IMU REALIGN, OPT 3
CSM CIRCULARIZATION
AGS INITIALIZATION
DPS PRESS AND C/O
LR ACTIVATION & SELF-TEST
P52 IMU REALIGN, OPT 3
ALIGN AGS TO PGNCS
PDI
TOUCHDOWN
POST TOUCHDOWN CHECKS
P57–OPT3–A/T1
P57–OPT3–A/T2
P57–OPT3–A/T2
P22 LUNAR SURFACE NAV
CABIN PREP FOR EVA
EQUIP PREP
PLSS/OPS DONNING
FINAL SYSTEMS PREP
CABIN DEPRESS
FINAL PREP FOR EGRESS
EVA
POST EVA SYSTEMS CONFIG
PLSS O2 RECHARGE
PLSS/OPS DOFFING
POST EVA CABIN CONFIG
PLSS CHARGE
EVA DEBRIEFING
EVA PLANNING PERIOD
CABIN PREP FOR EVA
EQUIP PREP
PLSS DONNING
FINAL SYSTEMS CHECK
CABIN DEPRESS
FINAL PREP FOR EGRESS
EVA
POST EVA SYSTEMS CONFIG
PLSS/OPS DOFFING
PREP FOR EQUIP JETT
CABIN DEPRESS
EQUIP JETT
CABIN DEPRESS
LM SYSTEMS POWER UP
P57 LUNAR SURFACE ALIGN
P22 LUNAR SURFACE NAV
P57 LUNAR SURFACE ALIGN
P-12 POWERED ASCENT
GO/NO-GO FOR LIFTOFF
INITIALIZE AGS
LIFT-OFF
INSERTION
P52 IMU REALIGN, OPT 3
RR TRACK CSM
CSI BURN RCS
PLANE CHANGE RCS
CDH BURN RCS
TPI BURN RCS
MCC-1 RCS
MCC-2 – RCS
RCS BRAKING
DOCKING
TRANSFER AND STOW EQUIPMENT
DECONTAMINATION
CLOSE OUT LM
LM JETTISON
CSM SEPARATION
LM DEORBIT BURN
LM IMPACT
LM APOLLO 13
MISSION ACTIVITY
SUMMARY

APOLLO 13 MISSION EVENTS (LM)

G.E.T. HR:MIN:SEC	EVENT
58:00:00	LMP & CDR IVT TO LM (LM FAMILIARIZATION)
59:35:00	LMP & CDR IVT TO CSM
83:10:00	LMP IVT TO CSM (HOUSKEEPING)
85:00:00	LMP IVT TO CSM
96:45:00	LMP IVT TO LM
96:55:00	CDR IVT TO LM
97:15:00	PGNCS TURN–ON
97:30:00	DOCKED IMU COARSE ALIGN
98:00:00	DOCKED IMU FINE ALIGN
99:16:21	UNDOCKING & SEPARATION
100:00:00	P52 REFS (LDG SITE ORIENT)
102:10:00	P52 REFS
103:20:00	P63
103:30:28	PDI
103:42:02	TOUCHDOWN
104:00:00	P57 REFS
105:30:00	P22 LUNAR SURFACE NAV
105:55:00	PWR DWN IMU, LGC TO STANDBY
106:00:00	PREP FOR EVA

G.E.T. HR:MIN:SEC	EVENT
108:10:00	CDR EGRESS
108:22:00	LMP EGRESS
111:45:00	LMP EVA TERMINATION
111:54:00	CDR EVA TERMINATION
125:45:00	PREP FOR EVA
127:55:00	CDR EGRESS
128:05:00	LMP EGRESS
131:25:00	LMP EVA TERMINATION
131:40:00	CDR EVA TERMINATION
134:20:00	PGNCS – OPERATE
134:35:00	P57 LUNAR SURFACE ALIGN
135:00:00	P22 LUNAR SURFACE NAV
136:25:00	P57 LUNAR SURFACE ALIGN
136:40:00	P12 – POWERED ASCENT
137:09:16	APS LIFT–OFF B.T 7 MIN 8 SEC, ORBIT 43.9 x 8.7 NM
137:16:23	LUNAR ORBIT INSERTION
137:25:00	P52 REFS
138:00:00	P41 – RCS THRUST
138:06:01	RCS – CSI B.T 44.4 SEC ORBIT 44.9 x 43.4 NM
138:32:00	P41 RCS THRUSTING

G.E.T HR:MIN:SEC	EVENT
138:35:08	RCS PLANE CHANGE
138:40:00	RNDZ RADAR TRACKING
138:58:00	P41 RCS THRUSTING
139:04:14	RCS – CDH
139:45:41	RCS – TPI B.T 22.1 SEC ORBIT 60.6 x 43.6 NM
140:00:41	RCS – MCC_1
140:15:41	RCS MCC_2
140:50:00	DOCKING
142:35:00	CDR & LMP IVT TO CSM
143:04:00	LM JETTISON
143:09:00	CSM SEPARATION B.T 6.12 SEC ORBIT 57.7 x 55.3 NM
144:32:20	LM DEORBIT BURN B.T 75.2 SEC
145:00:18	LM LUNAR IMPACT LAT 3° S LONG 19.65° W

APOLLO 13 MISSION EVENTS (CSM)

G.E.T HR:MIN:SEC	EVENT
	LAUNCH 2:13 P.M. EST
	APRIL 11, 1970 1:13 P.M. CST
00:11:39.6	EARTH ORBIT INSERTION
00:25:00	P52 REFS
01:52:00	GDC ALIGN
02:35:27	TLI B.T 5 MIN 55.7 SEC
03:06:00	CSM/SIVB SEP
03:16:00	DOCKING
04:01:00	CSM/LM EJECTION B.T 3 SEC
04:14:00	SIVB EVASIVE MNVR
05:30:00	P52 PREF
06:05:00	P23 CISLUNAR NAV (5 SETS)
10:45:00	P52 REFS
11:15:00	P40/41 SPS/RCS THRUST
11:41:25	MCC_1
24:00:00	P52 REFS
29:00:00	P52 REFS
30:03:00	P40 SPS THRUST
30:15:00	TV TO 30:45
30:40:49	MCC_2 B.T 2.2 SEC
31:05:00	P23 CISLUNAR NAV (5 SETS)
49:00:00	P52 REFS
54:16:00	P52 REFS (PTC ORIENT)

G.E.T HR:MIN:SEC	EVENT
55:03:00	P40/41 SPS/RCS THRUST
55:24:53	MCC_3
58:00:00	LMP & CDR IVT TO LM FOR LM FAMILIARIZATION
59:35:00	LMP & CDR IVT TO CSM
71:20:00	P52 REFS (PTC ORIENT)
72:24:53	MCC_4
74:40:00	P52 PREF (LDG SITE ORIENT)
76:35:00	P40 SPS THRUST
77:24:53	LOI B.T 5 MIN 56.5 SEC
81:00:00	P52 REF (LDG SITE ORIENT)
81:45:20	DOI B.T 23.1 SEC
82:54:00	P52 REFS
83:10:00	LMP IVT TO LM–LM HOUSEKEEPING
85:00:00	LMP IVT TO CSM
95:50:00	TV TO 96:05
96:10:00	P52 PREF
96:45:00	LMP IVT TO LM
96:55:00	CDR IVT TO LM
99:16:21	UNDOCKING AND SEP.

G.E.T HR:MIN:SEC	EVENT
99:55:00	P52 REFS
100:05:00	P40 SPS THRUST
100:35:05	CIRCULARIZATION BURN B.T 3.9 SEC ORBIT 61.7 x 52.5 NM
100:40:00	P20 AUTO MNVR
101:35:00	P22 ORB NAV
102:07:00	P52 REFS, COAS CALIB.
102:25:00	P20 MNVR TO SXT & VHF TRACK ATT
103:55:00	P52 REFS
104:00:00	S/C CONTAMINATION FIELD PHOTOGRAPHY
105:20:00	P22 ORBITAL NAV
105:30:00	TRACK LAND MARKS
106:35:00	S/C CONTAMINATION FIELD PHOTOGRAPHY
106:55:00	ORBITAL SCIENCE PHOTOS
107:50:00	SOLAR CORONA PHOTOS
108:40:00	ORBITAL SCIENCE PHOTOS
109:00:00	P22 ORBITAL NAV AND LANDMARK TRACK
111:50:00	P52 PREF
113:20:00	P40 SPS THRUST

APOLLO 13 MISSION EVENTS (CSM) CONTINUED

G.E.T HR:MIN:SEC	EVENT
113:42:03	SPS PLANE CHANGE, B.T 10 SEC
	ORBIT 59.9 x 53.8 NM
114:00:00	P52 PREF (LIFTOFF ORIENT)
114:30:00	SOLAR CORONA & LIMB
	BRIGHTENING PHOTOS
125:50:00	P52 REF (LIFTOFF ORIENT)
126:40:00	ORBITAL SCIENCE & VERTICAL
	STEREO STRIP PHOTOS
128:22:00	TOPO PHOTOGRAPHY
130:50:00	ORBITAL SCIENCE & OBLIQUE
	STEREO PHOTOS
132:55:00	P22 ORB NAV & LDMK TRACK
133:30:00	P52 REFS
135:30:00	P52 REFS
137:32:00	P20 RENDEZVOUS NAV
140:15:00	P40 RCS THRUST
140:23:00	TV TO 140:35
140:50:00	CSM ACTIVE DOCKING
142:35:00	CDR & LMP IVT TO CSM
143:04:00	LM JETTISON
143:09:00	CSM SEPARATION B.T 6.12 SEC
	ORBIT 57.7 x 55.3 NM
144:25:00	P20 RENDEZVOUS NAV

G.E.T HR:MIN:SEC	EVENT
153:15:00	P52 REFS
153:48:00	P40 SPS THRUST
154:13:11	SPS PLANE CHANGE$_2$ B.T 43 SEC
	ORBIT 58.4 x 53.6 NM
155:10:00	P52 PREF
156:00:00	STRIP PHOTOGRAPHY
161:15:00	P52 REFS (PHOTO ORIENT),
	LANDMARK TRACK
163:00:00	P52 REFS, LANDMARK TRACK
165:20:00	P52 PREF (TEI ORIENT)
166:10:00	TV TO 166:50 (RECORD)
166:58:00	P40 SPS THRUST
167:28:48	TEI B.T 2 MIN 15 SEC
168:00:00	TV TO 168:25
168:30:00	P52 PREF (PTC ORIENT)
170:05:00	P23 CISLUNAR NAV &
	OPTICS CAL.
181:05:00	P52 REFS
181:55:00	P40/41 SPS/RCS THRUST
182:28:48	MCC–5
183:00:00	P23 CISLUNAR NAV
207:50:00	P52 REFS
208:00:00	P23 CISLUNAR NAV

G.E.T HR:MIN:SEC	EVENT
218:05:00	P52 REFS
218:35:00	P40/41 SPS/RCS THRUST
218:49:37	MCC–6
220:00:00	P23 CISLUNAR NAV
221:45:00	TV TO 222:00
232:00:00	P23 CISLUNAR NAV
235:30:00	P52 REFS
235:50:00	P23 CISLUNAR NAV
236:35:00	P52 PREF (ENTRY ORIENT)
237:35:00	P40/41 SPS/RCS THRUST
237:49:37	MCC–7
239:15:00	P52 REFS
240:00:00	STATE VECTOR UPDATE
240:34:00	CM/SM SEPARATION
240:49:37.6	EI = 400 KFT
240:56:41.6	GUIDANCE TERMINATION
240:57:43.6	DROGUE DEPLOYMENT
240:58:33.6	MAIN DEPLOYMENT
241:03:25.6	SPLASH DOWN

CSM BURN SCHEDULE

BURN MNVR	GETI/ BURN TIME	ΔV_R (FPS)	ULLAGE/ ΔV (FPS)	REFSMMAT	RESULTANT HA & HP	REMARKS
TLI	2:35:27.65 5 MIN 55.7 SEC	10,437.1	–		–,–	S–IVB BURN
CSM/LM EJECTION	04:01 3.0 SEC	0.4	NOT REQ'D	PAD		RCS BURN
MCC–1	11:41:25		–	PTC		NOM. ZERO
MCC–2	30:40:49 2.2 SEC	15.1	NOT REQ'D	PTC		SPS BURN
MCC–3	55:24:53		–	PTC		NOM. ZERO
MCC–4	72:24:53		–	LDG SITE		NOM. ZERO
LOI	77:24:53 5 MIN 56.5 SEC	2815.3	NOT REQ'D	LDG SITE	HA 168.3 HP 57.0	SPS BURN
DOI	81:45:20 23.1 SEC	212.9	2 JET 19 SEC	LDG SITE	HA 57.4 HP 7.1	SPS BURN
UNDOCK & SEP	99:16:21	1.0				RCS BURN

BURN MNVR	GETI/ BURN TIME	ΔV_R (FPS)	ULLAGE/ ΔV (FPS)	REFSMMAT	RESULTANT HA & HP	REMARKS
CIRC. BURN	100:35:05 3.9 SEC	70.4	2 JET 15 SEC	LDG SITE	HA 61.7 HP 52.5	SPS BURN
PC–1	113:42:03 10.0 SEC	183.6	2 JET 15 SEC	PLANE CHANGE	HA 59.9 HP 53.8	SPS BURN
CSM SEP MNVR	143:09 6.12 SEC	1.0	N/A	LIFTOFF	HA 57.7 HP 55.3	RCS BURN
PC–2	154:13:11 43 SEC	824.6	2 JET 15 SEC	PLANE CHANGE	HA 58.4 HP 53.6	SPS BURN
TEI	167:28:48 2 MIN 14.9 SEC	3147.7	2 JET 17 JET	TEI		SPS BURN
MCC–5	182:28:48		–	PTC		NOM. ZERO
MCC–6	218:49:37.6		–	PTC		NOM. ZERO
MCC–7	237:49:37.6		–	ENTRY		NOM. ZERO
EI	240:49:37.6		–	–		

NOTE: HA & HP ARE HEIGHTS ABOVE MEAN LUNAR RADIUS (938.49 nm.)

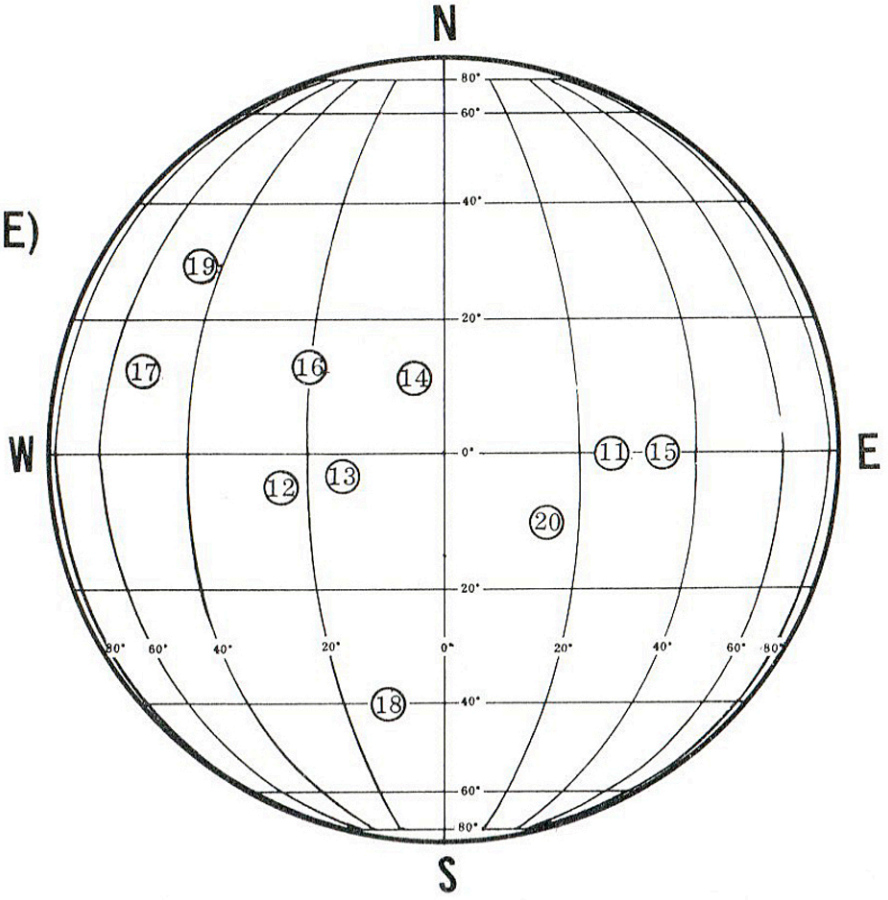
LM BURN SCHEDULE

BURN/ MNVR	GETI/ BURN TIME	ΔVR (FPS)	ULLAGE/ ΔV (FPS)	REFSMMAT	RESULTANT HA & HP	REMARKS
PDI	103:30:27.8 11 MIN 0.2 SEC	6592.5	2 JET 7.5	LDG SITE		
ASCENT	137:09:16.0 7 MIN 7.3 SEC	6044.4	NONE	LIFT–OFF	HA 43.9 HP 8.7	APS BURN
CSI	138:06:01 44.4 SEC	49.6	– – – –	LIFT–OFF	HA 44.9 HP 43.4	RCS BURN
PLANE CHANGE	138:35:08	– – – –	– – – –	LIFT–OFF	HA 44.8 HP 43.3	RCS BURN NOM. ZERO
CDH	139:04:14	– – – –	– – – –	LIFT–OFF	HA 44.8 HP 43.3	RCS BURN NOM. ZERO
TPI	139:45:41 22.1 SEC	24.7	– – – –	LIFT–OFF	HA 60.7 HP 43.7	RCS BURN
MCC–1	140:00:41	– – – –	– – – –	LIFT–OFF	HA 60.6 HP 43.6	RCS BURN NOM. ZERO
MCC–2	140:15:41	– – – –	– – – –	LIFT–OFF	HA 60.6 HP 43.6	RCS BURN NOM. ZERO
LM DEORBIT	144:32:20.2 75.2 SEC	185.5	– – – –	LIFT–OFF	– – – –	RCS BURN

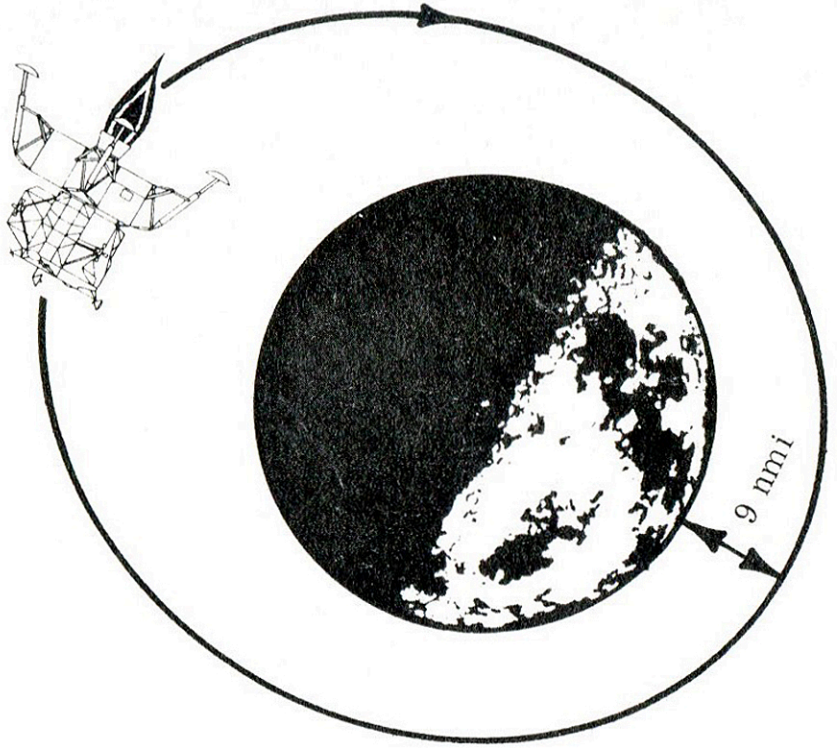
NOTE: HA & HP ARE HEIGHTS ABOVE MEAN LUNAR RADIUS (938.49 nm.)

LUNAR LANDING TARGETS

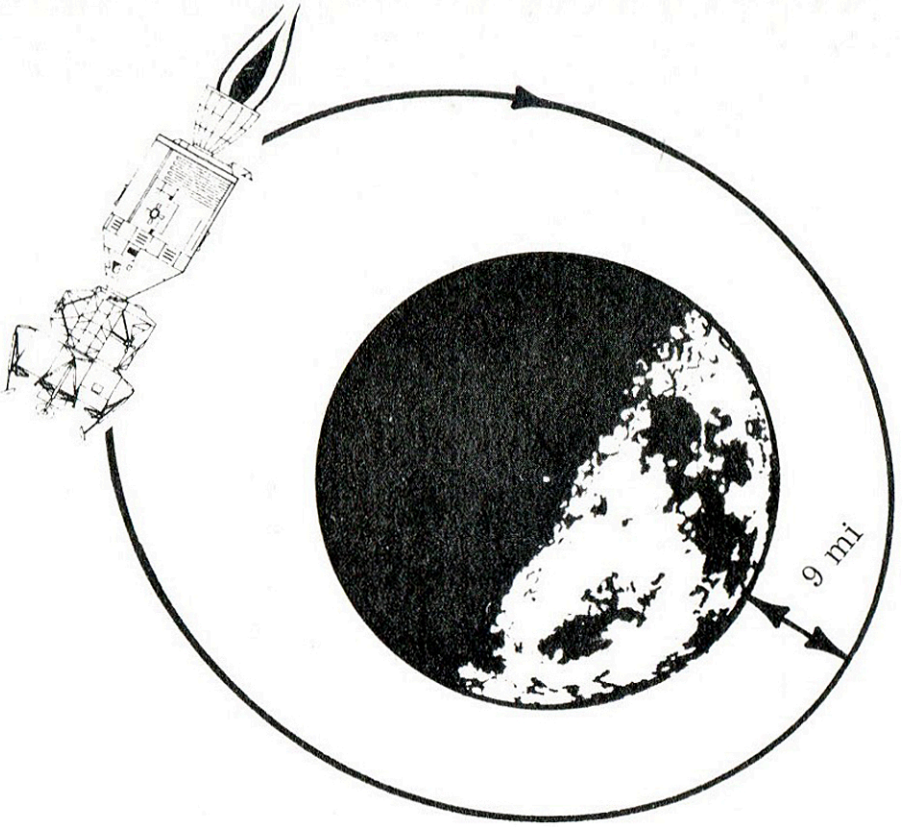
MISSION NO	
APOLLO 11	LANDING SITE 2 (TRANQUILITY BASE)
APOLLO 12	LANDING SITE 7
APOLLO 13	FRA MAURO FORMATION
APOLLO 14	RIMA BODE 2
APOLLO 15	CENSORINUS (NORTHWEST)
APOLLO 16	COPERNICUS (CENTRAL PEAKS)
APOLLO 17	MARIUS HILLS
APOLLO 18	TYCHO (NORTH RIM)
APOLLO 19	RIMA PRINZ 1



DOI ON LOI DAY



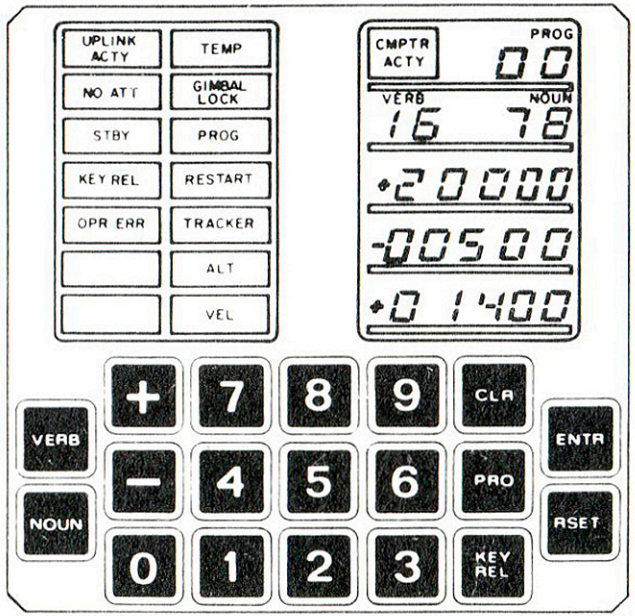
APOLLO 11 AND 12 – DOI ON REVOLUTION 14
60/60 nmi TO 60/9 nmi
28 s DPS BURN
ΔV = 72.1 ft/s RETROGRADE
THRUST ACCELERATION $\approx$ 4 ft/s^2



APOLLO 13 – DOI ON REVOLUTION 3
59/170 nmi TO 59/9 nmi
23 s SPS BURN
ΔV = 212 ft/s RETROGRADE
THRUST ACCELERATION $\approx$ 9 ft/s^2

TYPICAL LUNAR LANDING DSKY ENTRIES
PROGRAM 63

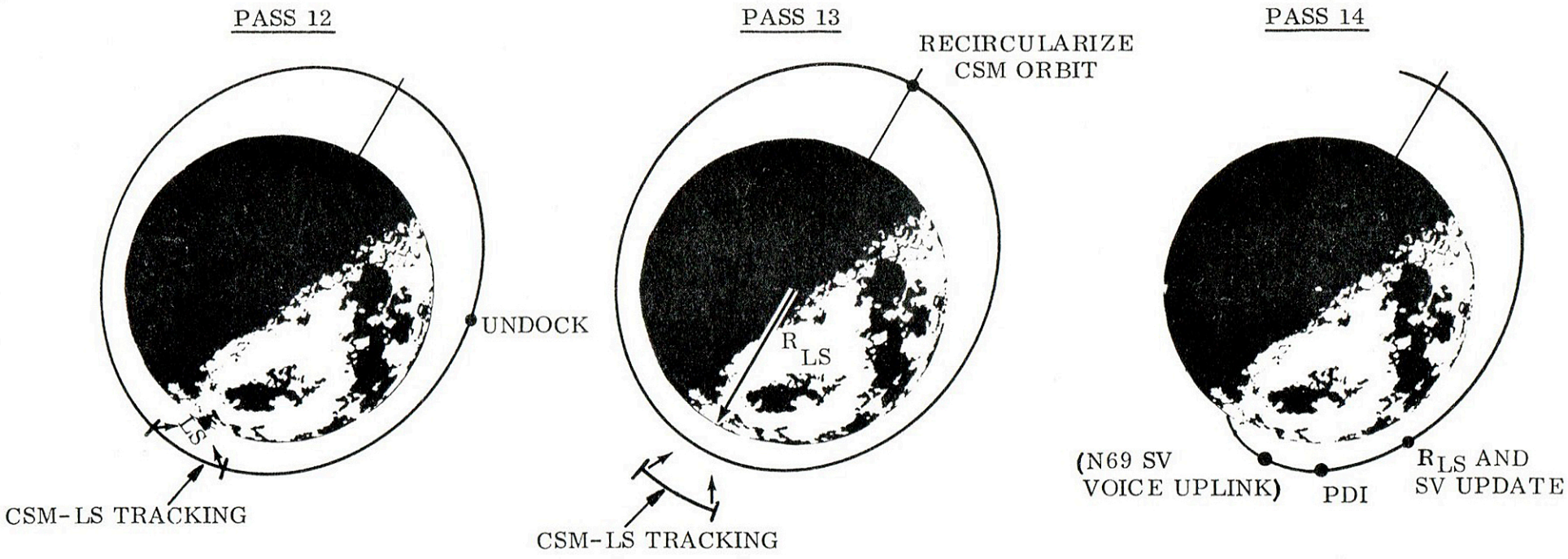
V37E 63E
F V06 N61 TIME TO GO
TIME FROM IGNITION
CROSSRANGE DISTANCE
N33E
F V06 N33 TIME OF IGNITION
PROCEED
F V50 N18 ROLL, PITCH, YAW FOR PDI
PROCEED
V06 N62 TIME FROM IGNITION
DSKY BLANKS (TIG 35 SECONDS)
ENGINE ARM TO – (DESCENT)
V06 N62 COUNTDOWN CONTINUES (TIG-30)
ULLAGE
F V99 N62 ENGINE ON ENABLE (TIG-5)
PROCEED
IGNITION
V06 N63 INERTIAL VELOCITY
H DOT (ALTITUDE RATE)
H (ALTITUDE)
V21 N69E LANDING SITE CORRECTIONS
V57 E PERMIT LR UPDATE
THROTTLE DOWN (6 min XX s)
PROGRAM 64 DISPLAYED
F V06 N64



TYPICAL LUNAR LANDING DSKY ENTRIES
PROGRAMS 64 AND 66

F V06 N64 TIME TO GO AND LPD ANGLE
H DOT
H
PROCEED (USE LPD)
V06 N64
REDESIGNATE LANDING SITE
PGNS MODE TO ATTITUDE HOLD
ACTUATE ROD SWITCH
PROGRAM 66 DISPLAYED
V06 N60 HORIZONTAL VELOCITY
H DOT
H
INPUT ROD AS DESIRED
LUNAR CONTACT LIGHT – ON
ENGINE STOP PUSH
STAY/NO STAY DECISION
V37E N68E LANDING CONFIRMATION
PROGRAM

APOLLO 13 NAVIGATION PLAN FOR LANDING



FRA MAURO LANDING SITE

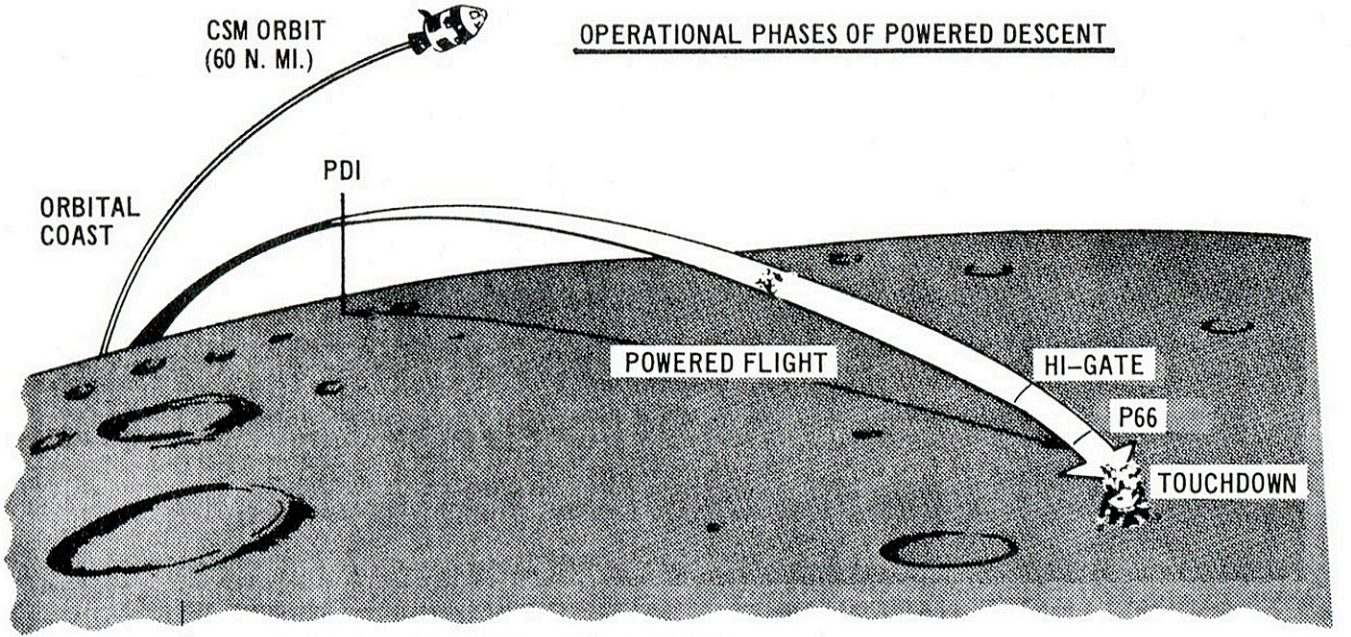
3.62 DEG SOUTH LAT

17 5 DEG WEST LONG.

DESCENT EVENTS

EVENT	TIME HR:MIN:SEC G.E.T.	TIME HR:MIN:SEC C.S.T.	DATA SUMMARY	
DESCENT				
CSM/LM Undock and SEP	99:16:21.0	April 15, 1970 16:29:21.0	Revolution Number	12
CIRCULARIZATION (CSM)				
Burn Initiation	100:35:05.2	17:48:05.2	Mass, lb	36 631.0
			Selenographic Latitude, deg	1.2
			Selenographic Longitude, deg	−166.3
			Selenographic Inclination, deg	5.3
			Altitude Above LLS, nmi	58.3
			Perilune Altitude Above LLS, nmi	8.9
			Velocity, fps	5,284.8
			Revolution Number	13
Burn Termination	100:35:09.1	17:48:09.1	ΔV, fps	70.3
			Burn duration, sec	3.9
			Altitude Above LLS, nmi	58.3
			Perilune Altitude Above LLS, nmi	54.3
			Apolune Altitude Above LLS, nmi	63.6
			Velocity, fps	5,353.6
			SPS Propellant Consumed, lb	254.8
			Burn arc, deg	0.2
			Period, hr:min:sec	01:58:24.6
PDI (DPS Ignition Time)	103:30:35.3	20:43:35.4	Altitude Above LLS, ft	51 076
			Velocity, fps	5,577
			Revolution Number	14
High Gate (P63 to P64)	103:39:05.3	20:52:05.3	Altitude Above LLS, ft	7,437
			Velocity, fps	492
Low Gate (500 ft)	103:40:51.3	20:53:51.3	Altitude Above LLS, ft	538
			Velocity, fps	62
Vertical Descent	103:41:29.3	20:54:29.3	Altitude Above LLS, ft	120
			Velocity, fps	7.0
Landing	103:42:01.5	20:55:01.5	ΔV, fps	6,625
			Burn Duration, min:sec	11:26
			DPS Propellant Consumed, lb	16 672
			Revolution Number	14

OPERATIONAL PHASES OF POWERED DESCENT

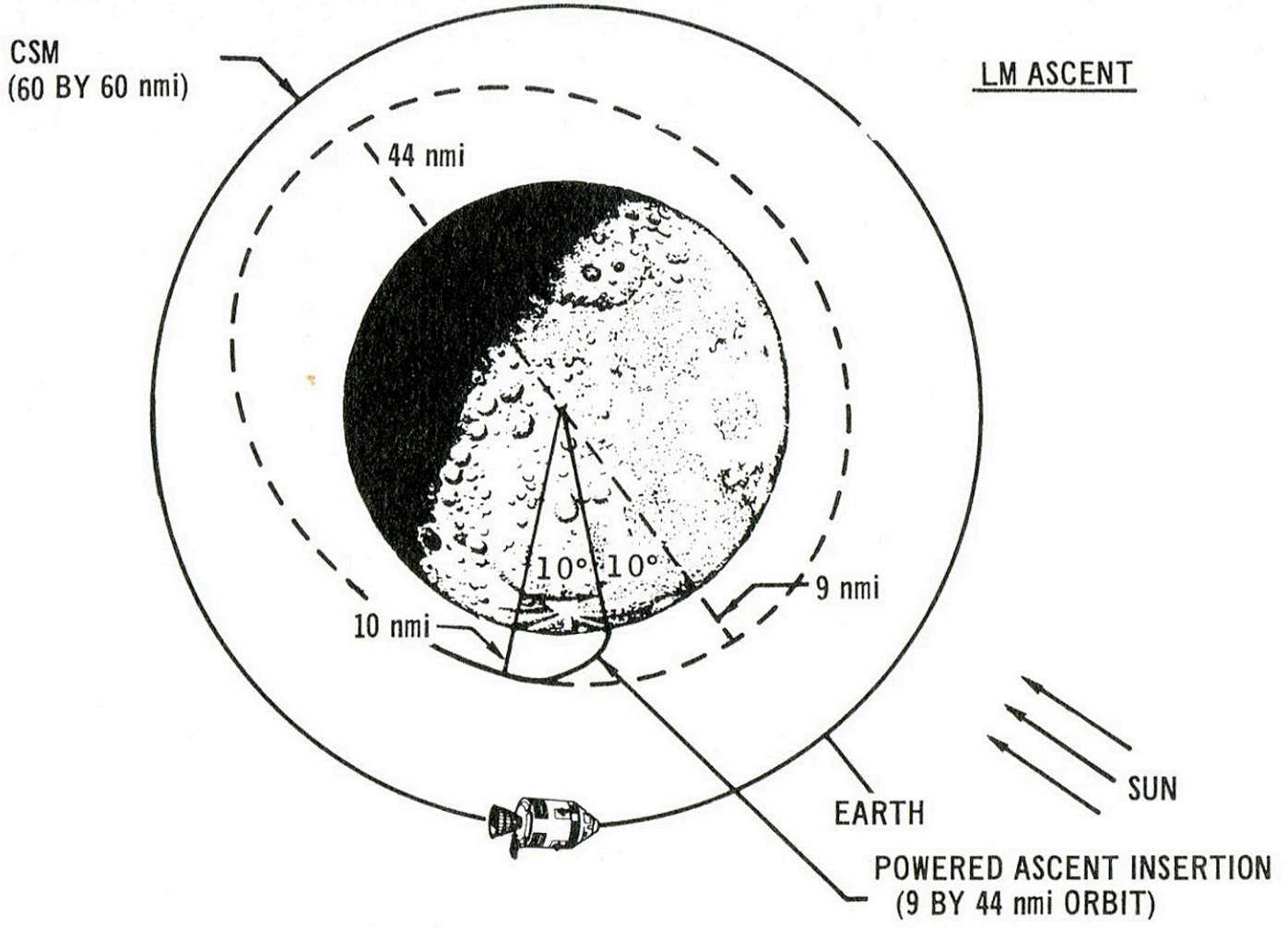


- P63-BRAKING PHASE (PDI TO HI-GATE)
- P64-VISIBILITY PHASE (HI-GATE TO CREW SELECTION OF P66)
- P66-LANDING PHASE (P66 TO TOUCHDOWN)

ASCENT EVENTS

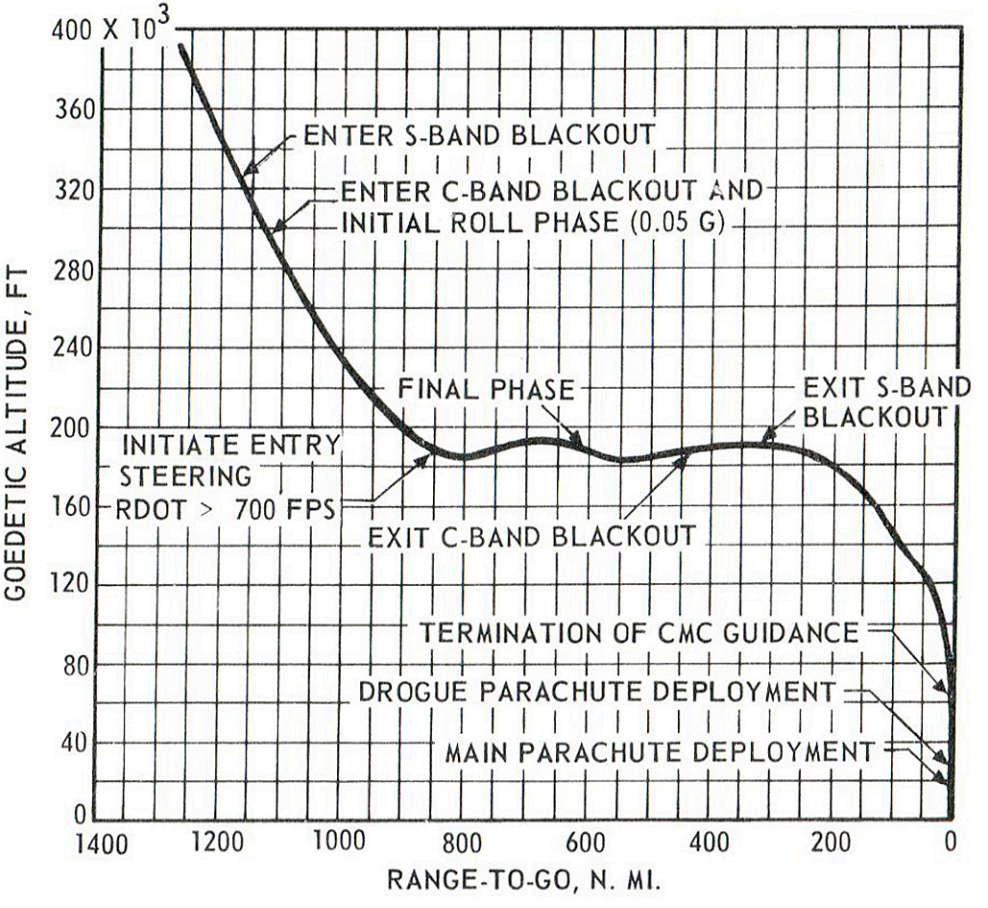
Event	Time, hr:min:sec, g.e.t.	Time, hr:min:sec, c.s.t.	Data Summary	
Ascent				
LM lift-off	137:09:15.8	April 17, 1970 06:22:15.8	Mass, lb	10 688.9
			Selenographic latitude, deg	−3.6
			Selenographic longitude, deg	−17.5
			Revolution number	31
LM insertion	137:16:23.1	06:29:23.1	Weight, lb	5795.7
			ΔV, fps	6044.4
			Burn duration, sec	427.3
			Latitude, deg	−4.1
			Longitude, deg	−27.6
			Altitude above LLS, ft	59 963.0
			Perilune altitude above LLS, ft	53 096.8
			Apolune altitude above LLS, ft	266 838.3
Rendezvous				
CSI	138:19:00.9	07:32:00.9	Revolution number	32
			Burn duration, sec	44.4
			ΔV, fps	49.6
			Propellant used, lb	31.7
			Resultant h_a/h_p, n. mi.	45.0/43.5
			Range at cutoff, n. mi.	147.8
			Range rate at cutoff, fps	−119.9
			Propulsion system	LM RCS
CDH	139:04:14.1	08:37:14.1	Burn duration, sec	0.0
			ΔV, fps	0.0
TPI	139:45:40.1	08:58:40.1	Burn duration, sec	22.1
			ΔV, fps	24.7
			Propellant used, lb	15.8
			Resultant h_a/h_p, n. mi.	60.8/43.8
			Range at cutoff, n. mi.	31.6
			Range rate at cutoff, fps	−131.2
			Propulsion system	LM RCS
			Revolution number	32

Event	Time, hr:min:sec, g.e.t.	Time, hr:min:sec, c.s.t.	Data Summary	
Braking	140:26:55.5	09:39:55.5	Burn duration, sec	27.4
			ΔV, fps	30.8
			Propellant used, lb	19.5
			Range at final braking, n. mi.	0.01
			Range rate at final braking, fps	−0.2
			h_a/h_p at final braking, n. mi.	59.4/58.0
			Propulsion system	LM RCS
			Revolution number	33
Docking	140:45:00.0	09:58:00.0		
LM jettison	143:04:00	12:17:00	Selenographic latitude, deg	−3.8
			Selenographic longitude, deg	−24.0
CSM SEP	143:09:14.7	12:22:14.7	Mass, lb	35 802.7
			ΔV, fps	1.0
			Burn duration, sec	6.1
			Selenographic lattitude, deg	−4.5
			Selenographic longitude, deg	−40.0
			Altitude above LLS, n. mi.	59.4
			Perilune altitude above LLS, n. mi.	58.0
			Apolune altitude above LLS, n. mi.	59.6
			Plane change, deg	0.0
			Selenographic inclination, deg	4.9
			Velocity, fps	5346.9
			Revolution number	34
LM deorbit	144:32:20.2	13:45:20.2	Mass, lb	5283.9
			ΔV, fps	185.5
			Burn duration, sec	75.2
			Selenographic latitude, deg	3.1
			Selenographic longitude, deg	66.3
LM impact	145:00:18.2	14:13:18.2	Mass, lb	5176.6
			Selenographic latitude, deg	−3.0
			Selenographic longitude, deg	−19.7
			Velocity, fps	5507.8
			CSM latitude, deg	−3.5
			CSM longitude, deg	−19.1
			CSM revolution number	35


CSM
(60 BY 60 nmi)
LM ASCENT
44 nmi
10°
10°
9 nmi
10 nmi
EARTH
SUN
POWERED ASCENT INSERTION
(9 BY 44 nmi ORBIT)

TYPICAL ENTRY SEQUENCE

EVENT	TIME FROM 400 000 FT MIN:SEC
ENTRY	0:00
ENTER S-BAND COMMUNICATION BLACKOUT	:18
ENTER C-BAND COMMUNICATION BLACKOUT LOAD FACTOR 0.05g	:29
MAXIMUM HEATING RATE	1:10
GUIDANCE INITIATE AT R-DOT 700 FPS	1:18
MAXIMUM LOAD FACTOR (FIRST)	1:22
EXIT C-BAND COMMUNICATION BLACKOUT	2:52
EXIT S-BAND COMMUNICATION BLACKOUT	3:15
MAXIMUM LOAD FACTOR (SECOND)	5:36
TERMINATION OF CMC GUIDANCE	7:10
DROGUES PARACHUTE DEPLOYMENT	8:08
MAIN PARACHUTES DEPLOYMENT	8:55
SPLASHDOWN	13:50



CM COMPUTER PROGRAMS

PHASE	PROGRAM NUMBER	PROGRAM TITLE
Pre-launch and Service	00	CMC Idling
	01	Prelaunch or Service-Initialization
	02	Prelaunch or Service-Gyro Compassing
	03	Prelaunch or Service-Optical Verification of Gyro Compassing
	06	GNCS Power Down
	07	Systems Test
Boost	11	Earth Orbit Insertion Monitor (EOI)
	17	Transfer Phase Initialization Search (TPI)
Coast	20	Rendezvous Navigation
	21	Ground Track Determination
	22	Orbital Navigation
	23	Cislunar Midcourse Navigation
	27	CMC Update
Pre-thrusting	30	External Delta V
	31	Lambert Aimpoint Maneuver
	32	Co-elliptic Sequence Initiation (CSI)
	33	Constant Delta Altitude (CDH)
	34	Transfer Phase Initiation (TPI)
	35	Transfer Phase (Midcourse)
	37	Return to Earth (RTE)
	38	Stable Orbit Rendezvous (SOR)
	39	Stable Orbit Midcourse (SOM)

PHASE	PROGRAM NUMBER	PROGRAM TITLE
Thrusting	40	SPS
	41	RCS
	47	Thrust Monitor
Alignment	51	IMU Orientation Determination
	52	IMU Realign
	53	Back-up IMU Orientation Determination
	54	Back-up IMU Realign
Entry	61	Entry-Maneuver to CM/SM Separation Attitude
	62	Entry-CM/SM Separation and Pre-entry Maneuver
	63	Entry Initialization
	64	Entry-Post 0.05G
	65	Entry-Up Control
	66	Entry-Ballistic
	67	Entry-Final Phase
Abort	72	LM Co-elliptic Sequence Initiation (CSI) Targeting
	73	LM Constant Delta Altitude (CDH) Targeting
	74	LM Transfer Phase Initiation (TPI) Targeting
	75	LM Transfer Phase (Midcourse) Targeting
	76	LM Target Delta V
	77	LM TPI Search
	78	LM SOR Targeting
	79	LM SOM Targeting

LGC PROGRAMS

NUMBER	TITLE
SERVICE	
P00	LGC Idling
P06	PGNCS Power
P07	Systems Test (Non-flight)
ASCENT	
P12	Powered Ascent Guidance
COAST	
P20	Rendezvous Navigation
P21	Ground Track Determination
P22	RR Lunar Surface Navigation
P25	Preferred Tracking Attitude
P27	LGC Update
PRETHRUSTING	
P30	External Delta V
P32	Co-elliptic Sequence Initiation (CSI)
P33	Constant Delta Altitude (CDH)
P34	Transfer Phase Initiation (TPI)
P35	Transfer Phase Midcourse (TPM)

NUMBER	TITLE
THRUST	
P40	DPS Thrusting
P41	RCS Thrusting
P42	APS Thrusting
P47	Thrust Monitor
ALIGNMENTS	
P51	IMU Orientation Determination
P52	IMU Realign
P57	Lunar Surface Alignment
DESCENT & LANDING	
P63	Landing Maneuver Braking Phase
P64	Landing Maneuver: Approach Phase
P66	Rate of Descent Landing (Rod)
P68	Landing Confirmation
ABORTS & BACKUPS	
P70	DPS Abort
P71	APS Abort
P72	CSM Co-elliptic Sequence Initiation (CSI) Targeting
P73	CSM Constant Delta Altitude (CDH) Targeting
P74	CSM Transfer Phase Initiation (TPI) Targeting;
P75	CSM Transfer Phase Midcourse (TPM) Targeting
P76	Target Delta V

NOUN 70 CODES

R1: CELESTIAL BODY CODE OOODE

00	PLANET	27	ALKAID
01	ALPHERATZ	30	MENKENT
02	DIPHDA	31	ARCTURUS
03	NAVI	32	ALPHECCA
04	ACHERNAR	33	ANTARES
05	POLARIS	34	ATRIA
06	ACAMAR	35	RASALHAGUE
07	MENKAR	36	VEGA
10	MIRFAK	37	NUNKI
11	ALDEBARAN	40	ALTAIR
12	RIGEL		
13	CAPELLA		
14	CANOPUS		
15	SIRIUS		
16	PROCYON		
17	REGOR	41	DABIH
20	DNOCES	42	PEACOCK
21	ALPHARD	43	DENEB
22	REGULUS	44	ENIF
23	DENEBOLA	45	FOMALHAUT
24	GIENAH	46	SUN
25	ACRUX	47	EARTH
26	SPICA	50	MOON

P22 R2: LANDMARK DATA

LANDING SITE	10001
KNOWN SITE	10000
UNKNOWN SITE	20000

P23 R1: OOODE STAR ID

R2: OOCOO
C=0 HORIZON
C=1 EARTH LDMK
C=2 LUNAR LDMK

R3: OOCDO HORIZ ID
C=1 EARTH, 2 LUNAR
D=1 NEAR, 2 FAR

ABBREVIATIONS	
ACN	ASCENSION TRACKING STATION
AGS	ABORT GUIDANCE SYSTEM
ANG	ANTIGUA TRACKING STATION
AOS	ACQUISITION OF SIGNAL
APS	ASCENT PROPULSION SYSTEM
BDA	BERMUDA TRACKING STATION
BT	BURN TIME
CAL	CALIFORNIA TRACKING STATION
CDH	CONSTANT DIFFERENTIAL HEIGHT
CDR	COMMANDER
CES	CONTROL ELECTRONICS SYSTEM
CMC	COMMAND MODULE COMPUTER
CRO	CARNARVON TRACKING STATION
CSI	CONCENTRIC SEQUENCE INITIATION
CSM	COMMAND AND SERVICE MODULES
CYI	GRAND CANARY ISLAND
DAP	DIGITAL AUTOPILOT
DOI	DESCENT ORBIT INSERTION
DPS	DESCENT PROPULSION SYSTEM
EI	ENTRY INTERFACE
EMU	EXTRAVEHICULAR MOBILITY UNIT
EOI	EARTH ORBIT INSERTION
EPO	EARTH PARKING ORBIT
EVA	EXTRAVEHICULAR ACTIVITY
EVT	EXTRAVEHICULAR TRANSFER
FTP	FIXED THROTTLE POINT
GBM	GRAND BAHAMA TRACKING STATION
GDS	GOLDSTONE TRACKING STATION
g.e.t.	GROUND ELAPSED TIME
G.m.t.	GREENWICH MEAN TIME
G&N	GUIDANCE AND NAVIGATION
GYM	GUAYMAS TRACKING STATION
H_a	APOGEE ALTITUDE
HAW	HAWAII TRACKING STATION
H_p	PERIGEE ALTITUDE
IVC	INTERVEHICLE COMMUNICATIONS
IVT	INTRAVEHICULAR TRANSFER
LGC	LM GUIDANCE COMPUTER
LLM	LUNAR LANDING MISSION
LLS	LUNAR LANDING SITE
LM	LUNAR MODULE
LMP	LUNAR MODULE PILOT
LOI	LUNAR ORBIT INSERTION
LOS	LOSS OF SIGNAL
LPO	LUNAR PARKING ORBIT

ABBREVIATIONS	
LR	LANDING RADAR
MC	LM MIDCOURSE CORRECTION
MCC	MIDCOURSE CORRECTION
MER	MERCURY TRACKING SHIP
MGA	MIDDLE GIMBAL ANGLE
MIL	MERRITT ISLAND TRACKING STATION
MSFN	MANNED SPACE FLIGHT NETWORK
OGA	OUTER GIMBAL ANGLE
OPS	OXYGEN PURGE SYSTEM
PC	PLANE CHANGE
PDI	POWER DESCENT INITIATION
PGA	PRESSURE GARMENT ASSEMBLY
PGNCS	PRIMARY GUIDANCE & NAVIGATION CONTROL SUBSYSTEM
PLSS	PORTABLE LIFE SUPPORT SYSTEM
PRE	PRETORIA TRACKING STATION
PTC	PASSIVE THERMO CONTROL
RCS	REACTION CONTROL SUBSYSTEM
RDG	POSITION TARGET FOR LM DESCENT
RR	RENDEZVOUS RADAR
SECO	SIVB ENGINE CUT-OFF
SLA	SPACECRAFT LM ADAPTER
SPS	SERVICE PROPULSION SYSTEM
S-IC	SATURN IC, LV FIRST STAGE
S-II	SATURN II, LV SECOND STAGE
S-IVB	SATURN IVB, LV THIRD STAGE
TAN	TANANARIVE TRACKING STATION
TEC	TRANSEARTH COAST
TD&E	TRANSPOSITION & DOCKING & EXTRACTION
TEI	TRANSEARTH INSERTION
TEX	CORPUS CHRISTI TRACKING STATION
TLC	TRANSLUNAR COAST
TLI	TRANSLUNAR INJECTION
TPF	TERMINAL PHASE FINALIZATION
TPI	TERMINAL PHASE INITIALIZATION
TPM	TERMINAL PHASE MIDCOURSE
TVC	THRUST VECTOR CONTROL
VAN	VANGUARD TRACKING SHIP
ΔV	VELOCITY CHANGE (DIFFERENTIAL)
ΔVC	VELOCITY CHANGE AT ENGINE CUT-OFF
ΔR	POSITION CHANGE (DIFFERENTIAL)

APOLLO 13 TV SCHEDULE

DAY	DATE	CST	GET	DURATION	ACTIVITY/SUBJECT	VEH	STA
SATURDAY	APR 11	4:28 PM	03:15	1 HR 08 MIN	TRANSPOSITION & DOCKING	CSM	GDS
SUNDAY	APR 12	7:28 PM	30:15	30 MIN	SPACECRAFT INTERIOR (MCC-2)	CSM	GDS
MONDAY	APR 13	11:13 PM	58:00	30 MIN	INTERIOR & IVT TO LM	CSM	GDS
WEDNESDAY	APR 15	1:03 PM	95:50	15 MIN	FRA MAURO LANDING SITE	CSM	MAD**
THURSDAY	APR 16	1:23 AM	108:10	3 HR 52 MIN	LUNAR SURFACE (EVA-1)	LM	GDS/HSK
THURSDAY	APR 16	9:03 PM	127:50	6 HR 35 MIN	LUNAR SURFACE (EVA-2)	LM	GDS
FRIDAY	APR 17	9:36 AM	140:23	12 MIN	DOCKING	CSM	MAD
SATURDAY	APR 18	11:23 AM	166:10	40 MIN	LUNAR SURFACE	CSM	MAD*
SATURDAY	APR 18	1:13 PM	168:00	25 MIN	LUNAR SURFACE (POST TEI)	CSM	MAD*
MONDAY	APR 20	6:58 PM	221:45	15 MIN	EARTH & SPACECRAFT INTERIOR	CSM	GDS

* Recorded only **Approval pending for satellite time